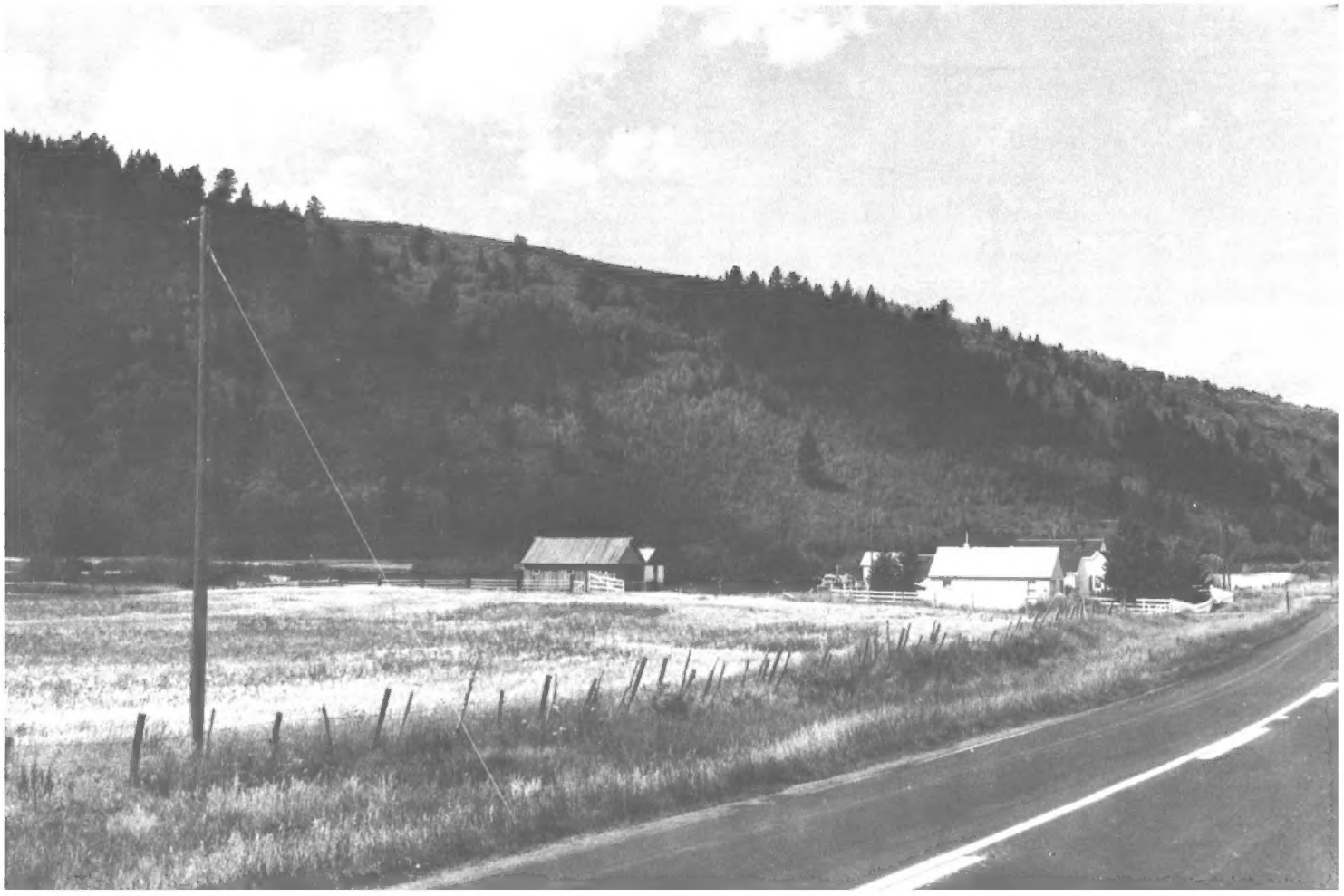
SOIL SURVEY OF

Star Valley Area, Wyoming - Idaho

Parts of Lincoln County, Wyoming, and Bonneville and Caribou Counties, Idaho



United States Department of Agriculture
Soil Conservation Service and
Forest Service
In cooperation with
Wyoming Agricultural Experiment Station and
Idaho Agricultural Experiment Station

This is a publication of the National Cooperative Soil Survey, a joint effort of the United States Department of Agriculture and agencies of the States, usually the Agricultural Experiment Stations. In some surveys, other Federal and local agencies also contribute. The Soil Conservation Service has leadership for the Federal part of the National Cooperative Soil Survey.

Major fieldwork for this soil survey was completed in the period 1966–69. Soil names and descriptions were approved in 1970. Unless otherwise indicated, statements in the publication refer to conditions in the county in 1969. This survey was made cooperatively by the Soil Conservation Service, the Forest Service, the Wyoming Agricultural Experiment Station, and the Idaho Agricultural Experiment Station. It is part of the technical assistance furnished to the Star Valley Conservation District in Wyoming and the East Side Soil and Water Conservation District in Idaho.

HOW TO USE THIS SOIL SURVEY

THIS SOIL SURVEY contains information that can be applied in managing farms and ranches; in selecting sites for roads, ponds, buildings, and other structures; and in judging the suitability of tracts of land for farming, industry, and recreation.

Locating Soils

All the soils of the Star Valley Area are shown on the detailed map at the back of this publication. This map consists of many sheets made from aerial photographs. Each sheet is numbered to correspond with a number on the Index to Map Sheets.

On each sheet of the detailed map, soil areas are outlined and are identified by symbols. All areas marked with the same symbol are the same kind of soil. The soil symbol is inside the area if there is enough room; otherwise, it is outside and a pointer shows where the symbol belongs.

Finding and Using Information

The "Guide to Mapping Units" can be used to find information. This guide lists all the soils of the Area in alphabetic order by map symbol and gives the capability classification of each. It also shows the page where each soil is described and the page for the range site in which the soil has been placed.

Individual colored maps showing the relative suitability or degree of limitation of soils for many specific purposes can be developed by using the soil map and the information in the text. Translucent material can be used as an overlay over the soil map and colored to show soils that have the same limitation or suitability. For example, soils that have a slight limitation for a given use can be colored green, those with a moderate limitation can be colored yellow, and those with a severe limitation can be colored red.

Farmers and those who work with farmers can learn about use and management of the soils from the soil descriptions and from the discussions of the capability units and the range sites.

Foresters and others can refer to the mapping unit descriptions, where the suitability of the soils for trees is discussed briefly.

Game managers, sportsmen, and others can find information about soils and wildlife in the section, "Wildlife."

Ranchers and others can find under "Range" groupings of the soils according to their suitability for range and also the names of many of the plants that grow on each range site.

Community planners and others can read about soil properties that affect the choice of sites for recreation areas in the section, "Recreation."

Engineers and builders can find under "Engineering Uses of the Soils" tables that contain test data, estimates of soil properties, and information about soil features that affect engineering practices.

Scientists and others can read about how the soils formed and how they are classified in the section, "Formation and Classification of the Soils."

Newcomers in the Star Valley Area may be especially interested in the section, "General Soil Map," where broad patterns of soil are described. They may also be interested in the section, "General Nature of the Area," which gives additional information about the Area.

Cover: **Typical dairy farm in Star Valley Area, Wyoming-Idaho. Leavittville complex is in foreground; Turson silt loam is on Salt River bottom land behind farmstead; Paulson-Osmund association is on most of the mountainside in the background; and Lail-Cowdrey association is in the heavily wooded areas.**

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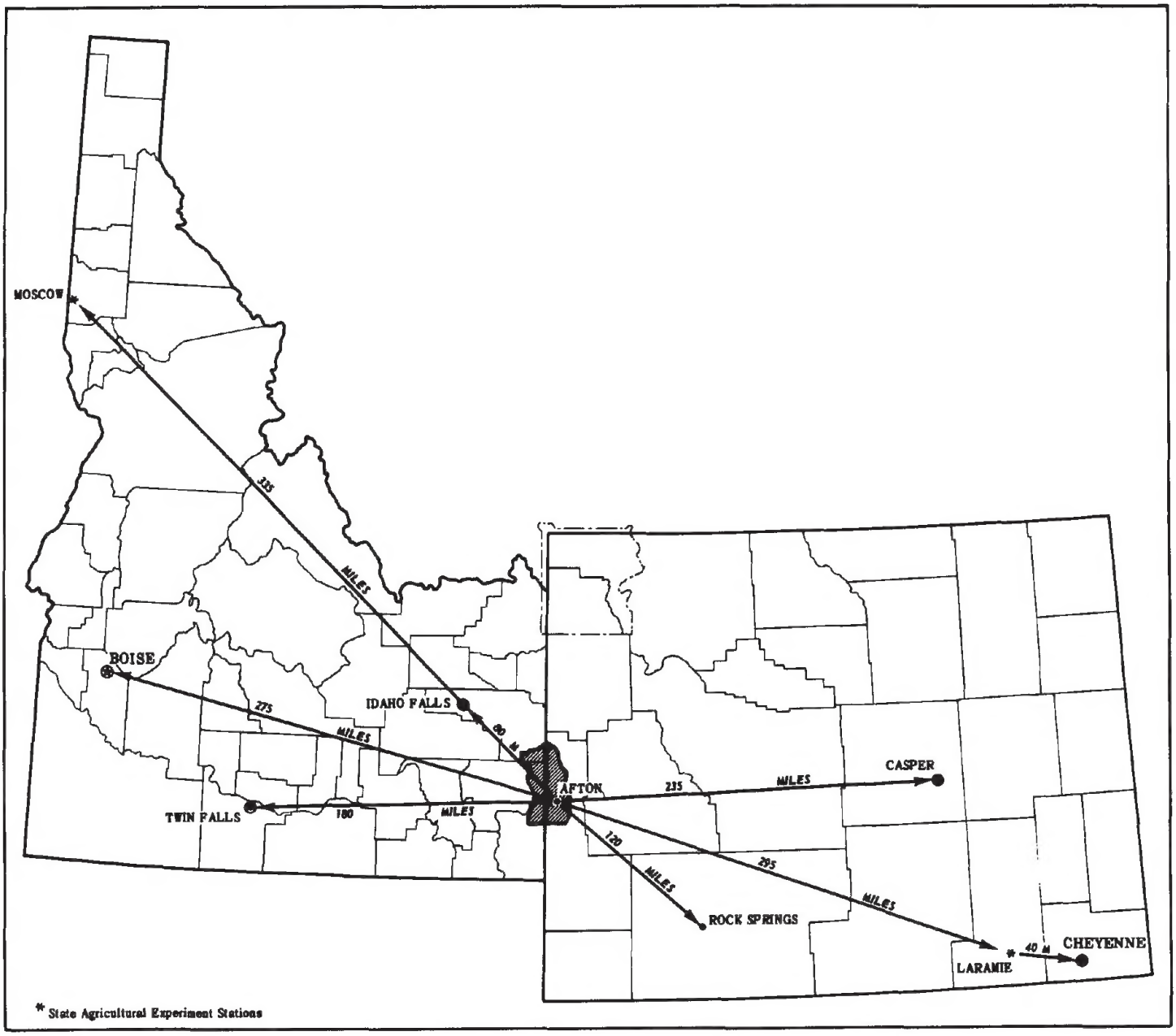
Issued March 1976



Location of Star Valley Area in Wyoming and Idaho.

SOIL SURVEY OF STAR VALLEY AREA, WYOMING-IDAHO

PARTS OF LINCOLN COUNTY, WYOMING, AND BONNEVILLE AND CARIBOU COUNTIES, IDAHO

BY HALVOR B. RAVENHOLT AND WILLIAM R. GLENN, SOIL CONSERVATION SERVICE, AND KERMIT N. LARSON, FOREST SERVICE[1]

UNITED STATES DEPARTMENT OF AGRICULTURE, SOIL CONSERVATION SERVICE AND FOREST SERVICE, IN COOPERATION WITH THE WYOMING AGRICULTURAL EXPERIMENT STATION AND THE IDAHO AGRICULTURAL EXPERIMENT STATION

STAR VALLEY AREA, Wyoming-Idaho: Parts of Lincoln County, Wyoming, and Bonneville and Caribou Counties, Idaho (hereinafter referred to as Star Valley Area), has a total area of 189,325 acres, or about 296 square miles. Of this, 139,261 acres is in Wyoming and 50,064 acres is in Idaho (see opposite page). Included is 7,273 acres of the Caribou National Forest in Wyoming.

Barley and alfalfa and bromegrass mixtures are the principal irrigated and dryland crops, but native hay is also an important crop. Most of the feed produced is used in the extensive dairying enterprise that flourishes throughout the area.

How This Survey Was Made

Soil scientists made this survey to learn what kinds of soil are in Star Valley Area, where they are located, and how they can be used. The soil scientists went into the county knowing they likely would find many soils they had already seen and perhaps some they had not. They observed the steepness, length, and shape of slopes, the size and speed of streams, the kinds of native plants or crops, the kinds of rock, and many facts about the soils. They dug many holes to expose soil profiles. A profile is the sequence of natural layers, or horizons, in a soil; it extends from the surface down into the parent material that has not been changed much by leaching or by the action of plant roots.

The soil scientists made comparisons among the profiles they studied, and they compared these profiles with those in counties nearby and in places more distant. They classified and named the soils according to nationwide, uniform procedures. The *soil series* and the *soil phase* are the categories of soil classification most used in a local survey.

Soils that have profiles almost alike make up a soil series. Except for different texture in the surface layer, all the soils of one series have major horizons that are similar in thickness, arrangement, and other important characteristics. Each soil series is named for a town or other geographic feature near the place where a soil of that series was first observed and mapped. Thayne and Narrows, for example, are the names of two soil series. All the soils in the United States having the same series name are essentially alike in those characteristics that affect their behavior in the undisturbed landscape.

Soils of one series can differ in texture of the surface layer and in slope, stoniness, or some other characteristic that affects use of the soils by man. On the basis of such differences, a soil series is divided into phases. The name of a soil phase indicates a feature that affects management. For example, Robana silt loam, 10 to 20 percent slopes, is one of several phases within the Robana series.

After a guide for classifying and naming the soils had been worked out, the soil scientists drew the boundaries of the individual soils on aerial photographs. These photographs show woodlands, buildings, field borders, trees, and other details that help in drawing boundaries accurately. The soil map at the back of this publication was prepared from aerial photographs.

The areas shown on a soil map are called mapping units. On most maps detailed enough to be useful in planning the management of farms and fields, a mapping unit is nearly equivalent to a soil phase. It is not exactly equivalent, because it is not practical to show on such a map all the small, scattered bits of soil of some kind that have been seen within an area that is dominantly of a recognized soil phase.

[1] ARVAD J. CLINE and CLARENCE J. FOWKES, soil scientists, Soil Conservation Service, assisted in the field correlation.

Some mapping units are made up of soils of different series or of different phases within one series. Three such kinds of mapping units are shown on the soil map of the Star Valley Area: soil complexes, soil associations, and undifferentiated groups.

A soil complex consists of areas of two or more soils so intricately mixed or so small in size that they cannot be shown separately on the soil map. Each area of a complex contains some of each of the two or more dominant soils and the pattern and relative proportions are about the same in all areas. Generally, the name of a soil complex consists of the names of the dominant soils joined by a hyphen. Hobacker-Osmund gravelly loams, 6 to 20 percent slopes, is an example of a complex.

A soil association is made up of adjacent soils that occur as areas large enough to be shown individually on the soil map but are shown as one unit because the time and effort of delineating them separately cannot be justified. There is a considerable degree of uniformity in pattern and relative extent of the dominant soils, but the soils may differ greatly one from another. The name of an association consists of the names of the dominant soils joined by a hyphen. Lail-Cowdrey association is an example.

An undifferentiated group is made up of two or more soils that could be delineated individually but are shown as one unit because, for the purpose of the soil survey, there is little value in separating them. The pattern and proportion of soils are not uniform. An area shown on the map may be made up of only one of the dominant soils or of two or more. Osmund and Mundos loams, 0 to 3 percent slopes, is an undifferentiated soil group in the Area.

In most areas surveyed there are places where the soil material is so rocky, so shallow, so severely eroded, or so variable that it has not been classified by soil series. These places are shown on the soil map and are described in the survey, but they are called land types and are given descriptive names. Stony rock land is a land type in the Area.

While a soil survey is in progress, soil scientists take soil samples needed for laboratory measurements and for engineering tests. Laboratory data from the same kind of soil in other places are also assembled. Data on yields of crops under defined practices are assembled from farm records and from field or plot experiments on the same kind of soil. Yields under defined management are estimated for all the soils.

Soil scientists observe how soils behave when used as a growing place for native and cultivated plants and as material for structures, foundations for structures, or covering for structures. They relate this behavior to properties of the soils. For example, they observe that filter fields for onsite disposal of sewage fail on a given kind of soil, and they relate this to the slow permeability of the soil or a high water table. They see that streets, road pavements, and foundations for houses are cracked on a named kind of soil and they relate this failure to the high shrink-swell potential of the soil material. Thus, they use observation and knowledge of soil properties, together with available research data, to predict limitations or suitability of soils for present and potential uses.

After data have been collected and tested for the key, or benchmark, soils in a survey area, the soil scientists set up trial groups of soils. They test these groups by further study and by consultation with farmers, agronomists, engineers, and others. They then adjust the groups according to the results of their studies and consultation. Thus, the groups that are finally evolved reflect up-to-date knowledge of the soils and their behavior under current methods of use and management.

General Soil Map

The general soil map at the back of this survey shows, in color, the soil associations in Star Valley Area. A soil association is a landscape that has a distinctive proportional pattern of soils. It normally consists of one or more major soils and at least one minor soil, and it is named for the major soils. The soils in one association may occur in another, but in a different pattern.

A map showing soil associations is useful to people who want a general idea of the soils in an area, who want to compare different parts of a county or area, or who want to know the location of large tracts that are suitable for a certain kind of land use. Such a map is a useful general guide in managing a watershed, a wooded tract, or a wildlife area, or in planning engineering works, recreational facilities, and community development. It is not a suitable map for planning the management of a farm or field, or for selecting the exact location of a road, building, or similar structure, because the soils in any one association ordinarily differ in slope, depth, stoniness, drainage, and other characteristics that affect their management.

The soil associations in Star Valley Area (fig. 2) are described in the following pages. Terms for texture in the descriptive headings of the associations refer to the surface layer of the major soils.

1. *Hobacker-Greyback-Leavittville association*

Nearly level to gently sloping, somewhat excessively drained and well drained gravelly loams and silt loams on alluvial fans and terraces

This association is on alluvial fans and terraces on the valley floor (fig. 3). The soils of this association formed in alluvium. Native vegetation was bunchgrasses and shrubs. Elevation ranges from 5,600 feet to 7,000 feet. The average annual precipitation is 18 to 21 inches, the average annual temperature is 42° to 46° F, and the frost-free season is 30 to 50 days.

This association makes up about 31 percent of the Area. It is about 20 percent Hobacker soils, 15 percent Greyback soils, 15 percent Leavittville soils, 10 percent Thayne soils, 10 percent Osmund soils, 10 percent Mundos soils, 10 percent Paulson soils, and 10 percent Huffine soils and Valleono soils.

Hobacker soils are on alluvial fans and terraces. They are gravelly loams that have very gravelly sandy loam and very gravelly loamy sand at a depth of 20 to 40 inches. Greyback soils are on alluvial fans. They are gravelly loams that have very gravelly loamy sand or sand at a depth of 20 to 40 inches. Leavittville soils are on alluvial fans and terraces. They are silt

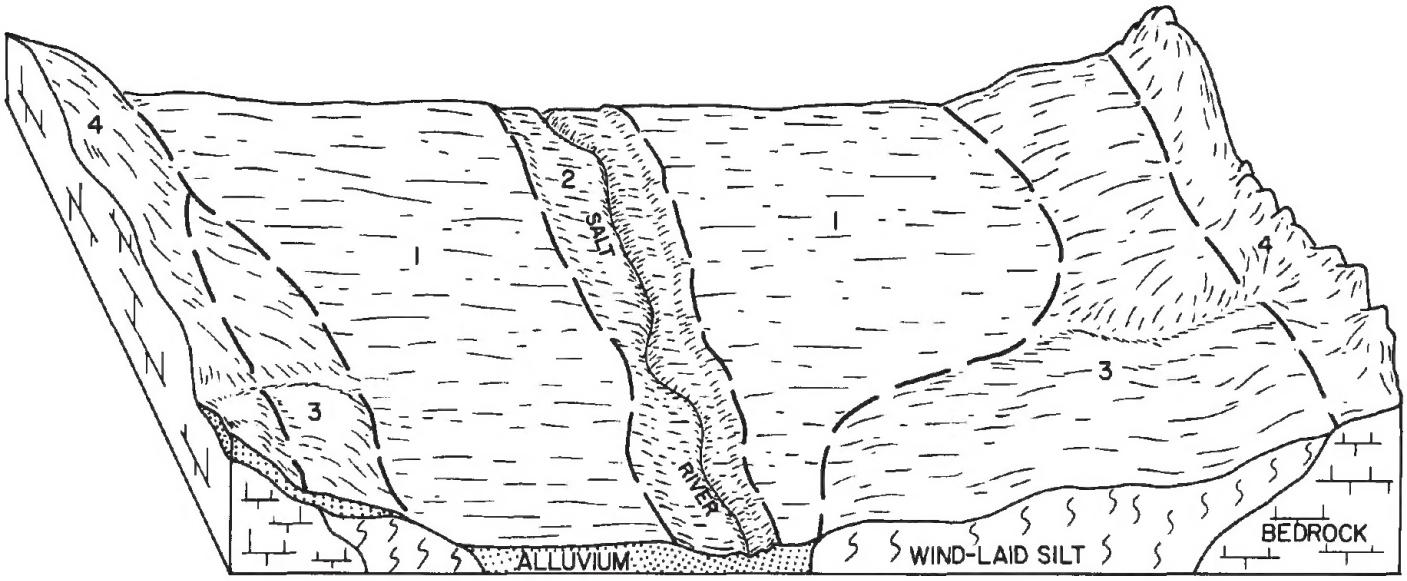


Figure 1.—Generalized cross-section of Star Valley Area showing the relative position of the four soil associations: 1. Hobacker-Greyback-Leavittville association; 2. Turson-Dipman association; 3. Robana-Buckskin-Cowdrey association; and 4. Paulson-Lail-Stony rock land association.

Figure 2.—Area of Osmund and Mundos gravelly loams, 3 to 6 percent slopes. Part of Hobacker-Greyback-Leavittville association is in foreground; part of the Paulson-Lail-Stony rock land association is in background. Grass- and shrub-covered slopes are occupied by Greyback and Rooset soils, and Redmanson soils are on timbered slopes.

loams that have very gravelly loams at a depth of 20 to 40 inches. Mundos and Thayne soils are on alluvial fans. Osmund and Paulson soils are on alluvial fans and terraces.

This association is used mainly for irrigated crops. It is also used for dryland crops, for range, and as wildlife habitat. Almost all of the farmsteads and urban areas in Star Valley Area are in this association.

2. *Turson-Dipman association*

Nearly level, somewhat poorly drained and poorly drained silt loams and silty clay loams on flood plains

This association is on flood plains of the Salt River and its tributaries. The soils of this association formed in alluvium. Vegetation is grasses, sedges, rushes, and willows. Elevation ranges from 5,600 to 7,000 feet. The average annual precipitation is 18 to 21 inches, the average annual temperature is 42° to 44° F, and the frost-free season is 30 to 50 days.

This association makes up about 13 percent of the Area. It is about 40 percent Turson soils; 15 percent Dipman soils; 35 percent Cryaquolls and Cryaquepts; 5 percent Narrows soils; and 5 percent Paulson, Valleono, and other minor soils.

Turson soils are somewhat poorly drained. They are silt loams that have very gravelly loamy sand at a depth of 20 to 40 inches. The water table fluctuates between depths of 3 and 5 feet. Dipman soils are poorly drained. Their surface layer is silty clay loam in the upper part and silty clay in the lower part. Very gravelly loam is at a depth of 20 to 40 inches. The water table is at a depth of 7 to 20 inches. Cryaquolls and Cryaquepts are poorly drained and very poorly drained and are variable in texture. The water table is at or near the surface most of the growing season.

Turson soils are used mainly for native pasture and as wildlife habitat. Some areas are used for irrigated crops. Dipman soils and Cryaquolls and Cryaquepts are used for native pasture and hay and as wildlife habitat. The association provides good habitat for waterfowl.

Most areas of this association are owned by farmers who live in the surrounding Hobacker-Greyback-Leavittville association. Only a very few farmsteads are in this association.

The water table is related to the level of the adjacent streams, and drainage is not feasible in most areas. This association is better suited to improved pasture, hay, crops, and wildlife habitat than to most other uses.

3. *Robana-Buckskin-Cowdrey association*

Rolling and hilly, deep, well-drained silt loams and clay loams on foot slopes and uplands

This association is on foot slopes and uplands surrounding the Valley and is also on isolated knolls on the valley floor. The soils of this association formed in wind-deposited silts, alluvium, and slope wash. Vegetation mainly is bunchgrass and shrubs but is trees, grasses, and shrubs in areas of Cowdrey and Turnerville soils. Elevation ranges from 5,600 to 7,200 feet. The average annual precipitation is 18 to 21 inches, the average annual temperature is 42° to 45° F, and the frost-free season is 30 to 50 days.

This association makes up about 22 percent of the Area. It is about 30 percent Robana soils, 15 percent Buckskin soils, 15 percent Cowdrey soils, 10 percent Decross soils, 10 percent Turnerville soils, and 20 percent Greyback, Willow Creek, Rooset, Bozeman, and Paulson soils.

Robana and Buckskin soils are on uplands. They are silt loams. Cowdrey soils are on forested foot slopes that face north. They are clay loams. Decross soils are on foot slopes. They are loams. Turnerville soils are on forested upland slopes that face north. They are silt loams.

Robana, Buckskin, and Decross soils are used mainly for dryland crops and range, but a small acreage is used for irrigated crops. Turnerville soils are used for dryland crops and grazed woodland. Cowdrey soils are used mainly for grazed woodland. All of the soils are used for wildlife habitat.

Most areas of this association are privately owned and are part of a farm or ranch. Headquarters for most of the farms and ranches are in the Hobacker-Greyback-Leavittville association, but a few are in this association. The vacation and summer homes in this association are increasing in number.

The hazard of water erosion is severe in some places, and soil and water conservation practices are needed for dryland crops and for homesites.

4. *Paulson-Lail-Stony rock land association*

Steep to very steep, well-drained silty clay loams and silt loams and Stony rock land on foothills and mountains

This association is on foothills and mountains surrounding the Valley. The soils of this association formed in alluvium, residuum from sandstone and limestone, and wind-deposited silt. Vegetation is bunchgrass, shrubs, and trees. Elevation ranges from 5,800 to 8,000 feet. The average annual precipitation is 18 to 21 inches, the average annual temperature is 42° to 45° F, and the frost-free season is 30 to 50 days.

This association makes up about 34 percent of the Area. It is about 20 percent Paulson soils; 10 percent Lail soils; 10 percent Stony rock land; and 60 percent Starley, Decross, Hobacker, Redmanson, Cowdrey, Greyback, Rooset, Osmund, Splitro, Robana, and other minor soils.

Paulson soils are steep to very steep and are on side slopes that face south and west. They are deep silty clay loams. Lail soils are steep to very steep and are on forested foot slopes that face north. They are deep silt loams. Stony rock land is very steep and is on mountains that face south and west. It consists of rock outcrop and very stony and gravelly colluvium.

Paulson soils are used for range and as wildlife habitat. Stony rock land is used as wildlife habitat. The association provides good habitat for deer and ruffed grouse.

Most areas that are privately owned in this association are parts of farms and ranches that have headquarters in the Hobacker-Greyback-Leavittville association. The 7,273 acres of the Caribou National Forest is in the area west of the Narrows.

Descriptions of the Soils

This section describes the soil series and mapping units in Star Valley Area. Each soil series is described in detail, and then, briefly, each mapping unit in that series. Unless it is specifically mentioned otherwise, it is to be assumed that what is stated about the soil series holds true for the mapping units in that series. Thus, to get full information about any one mapping unit, it is necessary to read both the description of the mapping unit and the description of the soil series to which it belongs.

An important part of the description of each soil series is the soil profile, that is, the sequence of layers from the surface downward to rock or other underlying material. Each series contains two descriptions of this profile. The first is brief and in terms familiar to the layman. The second is much more detailed and is for those who need to make thorough and precise studies of soils. The profile described in the series is representative of mapping units in that series. If the profile of a given mapping unit is different from the one described for the series, these differences are stated in describing the mapping unit, or they are differences that are apparent in the name of the mapping unit. Color terms are for dry soil unless otherwise stated.

As mentioned in the section "How This Survey Was Made," not all mapping units are members of a soil series. Stony rock land, for example, does not belong to a soil series but, nevertheless, is listed in alphabetic order along with the soil series.

Following the name of each mapping unit is a symbol in parentheses. This symbol identifies the mapping unit on the detailed soil map. Listed at the end of each description of a mapping unit is the capability unit and range site in which the mapping unit has been placed. The page for the description of each capability unit and range site can be found by referring to the "Guide to Mapping Units" at the back of this survey.

The acreage and proportionate extent of each mapping unit are shown in table 1. Many of the terms used in describing soils can be found in the Glossary, and more detailed information about the terminology and methods of soil mapping can be obtained from the Soil Survey Manual (*6*).[2]

Bozeman Series

The Bozeman series consists of well-drained soils that formed in wind-deposited silt on uplands. The soils are gently sloping to moderately steep, and slopes are 3 to 20 percent. Elevation ranges from 6,000 to 7,500 feet. Vegetation is mainly big sagebrush, serviceberry, Kentucky bluegrass, and bluebunch wheatgrass. The average annual precipitation is 18 to 21 inches, the average annual temperature is about 45° F, and the frost-free season is 30 to 50 days.

In a representative profile the surface layer is dark grayish-brown silt loam about 9 inches thick. The subsoil is grayish-brown silty clay loam and silt loam about 23 inches thick. The substratum is brown and pale-brown silt loam to a depth of 60 inches or more. The profile is neutral or mildly alkaline to a depth of 32 inches and is moderately alkaline below that depth.

Permeability is moderate. Available water capacity, to a depth of 60 inches, is 11 to 13 inches. Effective rooting depth is 60 inches or more.

These soils are used for dryland and irrigated crops, for range, and as wildlife habitat.

Representative profile of Bozeman silt loam, in an area of Willow Creek-Bozeman association, undulat-

[2] Italic numbers in parentheses refer to Literature Cited, page 73.

TABLE 1.—*Approximate acreage and proportionate extent of the soils*

Soil	Acres	Percent	Soil	Acres	Percent
Buckskin silt loam	710	0.4	Paulson silty clay loam, 6 to 10 percent slopes	350	.2
Buckskin-Decross association, undulating	3,980	2.1	Paulson silty clay loam, 10 to 20 percent slopes	1,140	.6
Buckskin-Decross association, hilly	5,600	3.0	Paulson-Rock land complex, 30 to 60 percent slopes	7,400	3.9
Cowdrey clay loam, 10 to 30 percent slopes	10,850	5.7	Paulson-Lail association	15,750	8.3
Cryaquolls and Cryaquepts	5,750	3.0	Paulson-Osmund association	2,900	1.5
Dipman silty clay loam	1,950	1.0	Paulson-Robana association, hilly	2,530	1.3
Dipman-Narrows association	3,410	1.8	Paulson-Robana association, steep	725	.4
Greyback gravelly loam	9,120	4.9	Redmanson association	2,580	1.4
Greyback and Hobacker soils, 0 to 30 percent slopes	2,910	1.5	Redmanson-Starley association	3,550	1.9
Greyback-Rooset association, hilly	6,955	3.7	Robana silt loam, 0 to 3 percent slopes	670	.4
Greyback-Rooset association, steep	7,130	3.8	Robana silt loam, 3 to 10 percent slopes	3,078	1.6
Hobacker gravelly sandy loam	1,165	.6	Robana silt loam, 10 to 20 percent slopes	3,330	1.8
Hobacker gravelly loam	7,240	3.8	Robana-Turnerville association, undulating	2,345	1.2
Hobacker cobbly loam	1,680	.9	Robana-Turnerville association, hilly	3,973	2.1
Hobacker-Osmund gravelly loams, 6 to 20 percent slopes	997	.5	Robana-Turnerville association, steep	1,110	.6
Hobacker-Osmund gravelly loams, 20 to 30 percent slopes	360	.2	Splitro complex, 6 to 30 percent slopes	1,400	.7
Huffine silt loam, 0 to 3 percent slopes	790	.4	Starley cobbly silty clay loam, 6 to 30 percent slopes	2,140	1.1
Huffine silt loam, 3 to 6 percent slopes	2,060	1.1	Starley complex, 6 to 30 percent slopes	2,550	1.3
Lail-Cowdrey association	5,930	3.1	Stony rock land	2,470	1.3
Leavittville complex	7,730	4.1	Thayne loam, 0 to 3 percent slopes	1,100	.6
Osmund and Mundos loams, 0 to 3 percent slopes	1,150	.6	Thayne loam, 3 to 6 percent slopes	330	.2
Osmund and Mundos loams, 3 to 6 percent slopes	233	.1	Thayne gravelly loam, 0 to 3 percent slopes	2,360	1.2
Osmund and Mundos gravelly loams, 0 to 3 percent slopes	9,200	4.9	Thayne gravelly loam, 3 to 6 percent slopes	2,350	1.2
Osmund and Mundos gravelly loams, 3 to 6 percent slopes	1,310	.7	Turson silt loam	9,200	4.9
Paulson silty clay loam, 0 to 3 percent slopes	4,830	2.6	Valleono silty clay loam	1,670	.9
Paulson silty clay loam, 3 to 6 percent slopes	500	.3	Willow Creek-Bozeman association, undulating	2,660	1.4
			Willow Creek-Bozeman association, hilly	2,550	1.3
			Gravel pits	164	.1
			Water	3,410	1.8
			Total	189,325	100.0

ing, in rangeland, about 2 miles east of Freedom and 1,150 feet north of the southwest corner, sec. 26, T. 35 N., R. 119 W., Lincoln County:

A1—0 to 5 inches, dark grayish-brown (10YR 4/2) silt loam, very dark brown (10YR 2/2) moist; moderate, fine, granular structure; soft, very friable, slightly sticky and slightly plastic; neutral; clear, smooth boundary.

A3—5 to 9 inches, dark grayish-brown (10YR 4/2) silt loam, very dark grayish brown (10YR 3/2) moist; weak, medium, subangular blocky structure parting to moderate, fine, granular; slightly hard, very friable, sticky and slightly plastic; neutral; clear, smooth boundary.

B21t—9 to 18 inches, dark grayish-brown (10YR 4/2) silty clay loam, very dark grayish brown (10YR 3/2) moist; moderate, medium, prismatic structure parting to moderate, medium, subangular blocky; hard, very friable, sticky and plastic; thin patchy clay films on horizontal and vertical faces of peds; neutral; gradual, smooth boundary.

B22t—18 to 25 inches, grayish-brown (10YR 5/2) silty clay loam, dark grayish brown (10YR 4/2) moist; moderate, medium, prismatic structure parting to moderate, medium, subangular blocky; hard, very friable, sticky and plastic; thin patchy clay films on horizontal and vertical ped faces; neutral; gradual, smooth boundary.

B3—25 to 32 inches, grayish-brown (10YR 5/2) silt loam, dark grayish brown (10YR 4/2) moist; weak, medium, subangular blocky structure; hard, very friable, sticky and plastic; few, thin, patchy clay films on vertical faces of peds; mildly alkaline; gradual, smooth boundary.

C1ca—32 to 45 inches, brown (10YR 5/3) silt loam, dark brown (10YR 4/3) moist; massive; slightly hard, very friable, slightly sticky and slightly plastic; violent effervescence; calcium carbonate as concretions and thin seams; moderately alkaline; gradual, smooth boundary.

C2ca—45 to 60 inches, pale-brown (10YR 6/3) silt loam, dark brown (10YR 4/3) moist; massive; slightly hard, very friable, slightly sticky and slightly plastic; strong effervescence; some secondary calcuim carbonate, but less than in C1ca horizon; moderately alkaline.

The A horizon has a hue of 7.5YR or 10YR, a value of 4 or 5 when dry and 2 or 3 when moist, and a chroma of 2 or 3 when dry or moist. It is neutral or mildly alkaline. The structure in the A horizon is generally granular or crumb, but it is weak subangular blocky in places.

The B21t horizon has a hue of 7.5YR or 10YR, a value of 4 or 5 when dry and 2 or 3 when moist, and a chroma of 2 or 3 when dry or moist. The B22t horizon has a hue of 7.5YR or 10YR, a value of 5 or 6 when dry and 3 to 5 when moist, and a chroma of 2 to 4 when dry or moist. It is neutral to mildly alkaline. The B2t horizon is hard or slightly hard, friable or very friable, sticky or very sticky, and plastic or very plastic.

The C horizon has a hue of 7.5YR or 10YR, a value of 5 or 6 when dry and 4 or 5 when moist, and a chroma of 3 or 4 when dry or moist.

Bozeman soils are mapped only in associations with Willow Creek soils.

Buckskin Series

The Buckskin series consists of well-drained and somewhat poorly drained soils that formed in wind-deposited silt and alluvium on ridgetops and mountain foot slopes. The soils are nearly level to moderately steep, and slopes are 0 to 20 percent. Elevation ranges from 6,000 to 7,500 feet. Vegetation is mainly big sagebrush, serviceberry, basin wildrye, and Kentucky bluegrass. The average annual precipitation is 18 to 21 inches, the average annual temperature is about 42° F, and the frost-free season is 30 to 50 days.

In a representative profile the surface layer is grayish-brown silt loam about 9 inches thick. The subsoil is brown silty clay loam and silty clay to a depth of 60 inches or more. The profile is neutral.

Permeability is moderately slow. Available water capacity, to a depth of 60 inches, is 9 to 11 inches. Effective rooting depth is 60 inches or more. The water table is generally very deep, but in some small areas it is at a depth of 30 inches part of the year.

These soils are used for range, for dryland and irrigated crops, and as wildlife habitat.

Representative profile of Buckskin silt loam, 3 to 10 percent slopes, in an area of Buckskin-Decross association, undulating, in a cultivated area, about 165 feet north of gate in National Forest boundary fence, in SW¼NW¼ sec. 9, T. 8 S., R. 46 E., Caribou County:

Ap—0 to 9 inches, grayish-brown (10YR 5/2) silt loam, very dark grayish brown (10YR 3/2) moist; moderate, medium and fine, subangular blocky structure parting to moderate, fine, granular; slightly hard, very friable, sticky and plastic; neutral; abrupt, smooth boundary.

B1—9 to 13 inches, brown (10YR 5/3) silty clay loam, dark brown (10YR 3/3) moist; strong, fine, subangular blocky structure parting to strong, very fine, subangular blocky; slightly hard, very friable, sticky and plastic; thin nearly continuous coatings of bleached sand and silt on surfaces of peds; neutral; clear, smooth boundary.

B21t—13 to 27 inches, brown (7.5YR 5/3) silty clay, dark brown (7.5YR 4/3) moist; strong, medium and fine, subangular blocky structure parting to strong, fine, angular blocky; very hard, friable, very sticky and very plastic; thin, nearly continuous, light coatings of bleached sand and silt on faces of peds; thin, nearly continuous, waxlike coatings on faces of peds and on the inside of root channels; neutral; gradual, wavy boundary.

B22t—27 to 60 inches, brown (7.5YR 5/3) silty clay, dark brown (7.5YR 4/3) moist; moderate, medium, prismatic structure parting to strong, medium, angular blocky; very hard, friable, very sticky and very plastic; thin coatings of bleached sand and silt on faces of peds; thin, continuous, waxlike coatings on faces of peds and in root channels; neutral.

The Ap horizon has a value of 4 or 5 when dry and 2 or 3 when moist and a chroma of 2 or 3 when dry or moist. It is silt loam or silty clay loam. It is weak or moderate, fine or very fine, granular or subangular blocky.

The B2t horizon has a hue of 7.5YR or 10YR, a value of 5 or 6 when dry and 4 when moist, and a chroma of 2 or 3 when dry or moist. It is silty clay or silty clay loam.

Buckskin silt loam (Bc).—This nearly level soil is in depressions and drainageways. The profile of this soil is similar to the one described as representative of the series, but the surface layer is very dark brown silt loam about 10 inches thick. The upper part of the subsoil is about 16 inches of dark grayish-brown silty clay that has a few, faint, dark-brown and dark grayish-brown mottles. The lower part of the subsoil is about 6 inches of light olive-brown clay loam that has common, large, distinct, yellowish-brown mottles. The substratum is light olive-brown gravelly clay loam that has many, large, distinct, yellowish-brown mottles and extends to a depth of 60 inches or more.

Included with this soil in mapping are areas of Decross silt loam and Turson silt loam, each of which makes up about 5 percent of the mapped areas.

Runoff is slow, and the hazard of erosion is slight.

This soil is somewhat poorly drained and has a fluctuating water table at a depth of 30 to 60 inches. It is generally flooded annually for very short periods in spring and early in summer. The flooding is caused by streams backing into the low areas occupied by this soil during peak flow. No damage results.

This soil is suited to dryland crops. It is used for range and as wildlife habitat. Capability unit IIIw–62 dryland; Subirrigated range site.

Buckskin-Decross association, undulating (BDC).—The Buckskin soil in this association is on ridgetops and upper parts of side slopes, and the Decross soil is on lower parts of side slopes. About 50 percent of this association is Buckskin silt loam, 3 to 10 percent slopes, and about 40 percent is Decross loam, 3 to 10 percent slopes. Included soils make up the remaining 10 percent. The Buckskin and Decross soils have the profiles described as representative of their respective series.

Included with these soils in mapping are small areas of Robana silt loam, Bozeman silt loam, and Willow Creek silt loam.

Runoff on the Buckskin and Decross soils is slow to medium, and the hazard of erosion is slight to moderate. These soils are well drained and do not have a water table.

This association is used for range, for dryland and irrigated crops, and as wildlife habitat. Barley is the main dryland crop. Barley and alfalfa-bromegrass hay are the main irrigated crops. Buckskin soil in capability units IIIe–1 dryland and IVe–1 irrigated; Loamy range site. Decross soil in capability units IIIe–2 dryland and IVe–2 irrigated; Loamy range site.

Buckskin-Decross association, hilly (BDD).—The Buckskin soil in this association is on ridgetops and upper parts of side slopes, and the Decross soil is on lower parts of mountain side slopes. About 60 percent is Buckskin silt loam, 10 to 20 percent slopes, and about 30 percent is Decross loam, 10 to 20 percent slopes. Included soils make up the remaining 10 percent.

Included with these soils in mapping are small areas of Robana silt loam, Rooset gravelly loam, and Cowdrey clay loam.

Runoff on the Buckskin soil is medium, and the hazard of erosion is moderate. Runoff on the Decross soil is medium, and the hazard of erosion is moderate. These soils are well drained and do not have a water table.

This association is used for range, for dryland crops, and as wildlife habitat. Barley is the main dryland crop. Some small, less sloping areas are used for irrigated barley and alfalfa-bromegrass hay. Buckskin soil in capability unit IVe–1 dryland; Loamy range site. Decross soil in capability unit IVe–2 dryland; Loamy range site.

Cowdrey Series

The Cowdrey series consists of well-drained soils that formed in slope wash on hillsides. The soils are moderately steep to very steep, and slopes are 10 to 50 percent. Elevation ranges from 6,000 to 7,500 feet. Vegetation is mainly quaking aspen, lodgepole pine, Douglas-fir, snowberry, pinegrass, and wild strawberry. The average annual precipitation is 18 to 21 inches, the average annual temperature is about 42° F, and the frost-free season is 30 to 50 days.

In a representative profile about 2 inches of undecomposed or partly decomposed organic matter overlies a surface layer of light-gray clay loam about 10 inches thick. The next layer is mixed light-gray and grayish-brown or brown clay loam or clay about 13 inches thick. The subsoil is brown to pale-brown clay and clay loam about 25 inches thick. The substratum is pale-brown clay loam to a depth of 60 inches or more. The profile is neutral or slightly acid.

Permeability is slow. Available water capacity, to a depth of 60 inches, is 6 to 11 inches. Effective rooting depth is 60 inches or more.

These soils are used mainly for grazed woodland and as wildlife habitat. A few areas have been cleared and used for hay.

Representative profile of Cowdrey clay loam, 10 to 30 percent slopes, in woodland, about 180 feet south of wet draw and 30 feet east of line fence in NW¼NW¼ sec. 28, T. 8 S., R. 46 E., Caribou County:

O1—2 inches to 1 inch, undecomposed leaves, twigs, and grass.

O2—1 inch to 0, partly decomposed leaves, twigs, and grass.

A2—0 to 10 inches, light-gray (10YR 7/2) clay loam, grayish brown (10YR 5/3) moist; weak, fine, subangular blocky structure parting to moderate, fine, granular; soft, very friable, sticky and plastic; 5 percent gravel; neutral; gradual, wavy boundary.

A&B—10 to 17 inches, light-gray (10YR 7/2) and grayish-brown (10YR 5/2) clay loam, grayish brown (10YR 5/2) and dark brown (10YR 4/3) moist; moderate, very fine, subangular blocky structure parting to moderate, fine, granular; hard, friable, very sticky and plastic; horizon consists of a matrix similar to the A2 horizon and material similar to the B2t horizon embedded in it; few, thin, glossy patches on some faces of clay peds; 5 percent gravel; neutral; gradual, wavy boundary.

B&A—17 to 23 inches, brown (10YR 5/3) and light-gray (10YR 7/2) clay, dark brown (10YR 4/3) and grayish brown (10YR 5/2) moist; moderate, fine, subangular blocky structure; hard, friable, very sticky and very plastic; horizon consists of a matrix similar to the B2t horizon and material similar to the A2 horizon embedded in it; many waxlike patches on faces of clay peds; waxlike coatings on inside of root channels; 5 percent gravel; neutral; gradual, wavy boundary.

B2t—23 to 40 inches, brown (10YR 5/3) clay, dark brown (10YR 4/3) moist; moderate, medium, angular blocky structure; extremely hard, firm, very sticky and very plastic; thin, continuous, waxlike coatings on faces of peds; waxlike coatings on inside of root channels; 10 percent gravel; slightly acid; gradual, wavy boundary.

B3—40 to 48 inches, pale-brown (10YR 6/3) clay loam, brown (10YR 5/3) moist; weak, medium, subangular blocky structure; extremely hard, firm, very sticky and very plastic; thin glossy and waxlike patches on some faces of peds; some waxlike coatings on inside of root channels; 10 percent gravel; slightly acid; gradual, wavy boundary.

C—48 to 60 inches, pale-brown (10YR 6/3) clay loam, brown (10YR 5/3) moist; massive; very hard, firm, very sticky and very plastic; 10 percent gravel; neutral.

The content of coarse fragments, gravel, cobbles, and stones ranges from 0 to 35 percent and increases as depth increases.

The A2 horizon has a value of 6 or 7 when dry and 4 or 5 when moist. It is generally clay loam but is loam or silt loam in places. It is neutral or slightly acid.

The B2t horizon has a hue of 7.5YR or 10YR, a value of 5 or 6 when dry and 4 or 5 when moist, and a chroma of 3

or 4 dry or moist. It is generally clay but is silty clay, silty clay loam, or clay loam in places. The B2t horizon is hard to extremely hard, firm or very firm, sticky or very sticky, and plastic or very plastic. It is slightly acid or neutral.

The C horizon has a hue of 7.5YR or 10YR.

Cowdrey clay loam, 10 to 30 percent slopes (COE).—This moderately steep to steep soil is on hillsides. The profile of this soil is the one described as representative of the series.

Included with this soil in mapping are areas of Buckskin silt loam, which makes up about 20 percent of the mapped areas, and areas of Lail silt loam, Rooset gravelly loam, and Decross loam, which make up about 10 percent.

Runoff is rapid, and the hazard of erosion is high.

This soil is mainly used for grazed woodland and as wildlife habitat. Its suitability for the production of fenceposts, poles, and sawtimber is low to medium. A few areas have been cleared and are used for dryland hay. Capability unit VIe–1 dryland; not assigned to a range site.

Cryaquolls and Cryaquepts

Cryaquolls and Cryaquepts (CR) consists of poorly drained and very poorly drained, nearly level soils on flood plains. Slopes are 0 to 3 percent. Elevation ranges from 5,600 to 7,000 feet. Vegetation is mainly sedges, rushes, and willows. The average annual precipitation is 18 to 21 inches, the average annual temperature is about 40° F, and the frost-free season is 30 to 50 days.

These soils range from loam to silty clay. Some have a peaty surface layer, some are gravelly throughout, and many are very gravelly at a depth of 20 to 40 inches. The water table is at or near the surface most of the growing season.

Runoff is ponded, and the hazard of erosion is slight. These soils are generally flooded annually for short periods in spring and early in summer.

These soils are used for native pasture, for native hay, and as wildlife habitat. Capability unit Vw–64 dryland; Wetland range site.

Decross Series

The Decross series consists of well-drained soils that formed in alluvium on mountain foot slopes. The soils are gently sloping to very steep, and slopes are 3 to 60 percent. Elevation ranges from 5,600 to 7,500 feet. Vegetation is mainly big sagebrush, serviceberry, Kentucky bluegrass, and basin wildrye. The average annual precipitation is 18 to 21 inches, the average annual temperature is about 43° F, and the frost-free season is 30 to 50 days.

In a representative profile the surface layer is dark grayish-brown loam about 8 inches thick. The upper part of the subsoil is dark grayish-brown silty clay loam about 13 inches thick. The lower part of the subsoil is brown clay loam about 15 inches thick. The substratum is brown clay loam to a depth of 60 inches or more. The profile is neutral to moderately alkaline.

Permeability is moderate. Available water capacity, to a depth of 60 inches, is 9 to 12 inches. Effective rooting depth is 60 inches or more.

These soils are used for range, for dryland and irrigated crops, and as wildlife habitat.

Representative profile of Decross loam, 3 to 10 percent slopes, in an area of Buckskin-Decross association, undulating, in rangeland, across from cheese factory in the southeast corner, NW¼SE¼ sec. 23, T. 34 N., R. 119 W., Lincoln County:

A11—0 to 3 inches, dark grayish-brown (10YR 4/2) loam, very dark brown (10YR 2/2) moist; weak, very fine, granular structure; soft, very friable, slightly sticky and slightly plastic; 5 percent gravel; neutral; clear, wavy boundary.

A12—3 to 8 inches, dark grayish-brown (10YR 4/2) loam, very dark grayish brown (10YR 3/2) moist; weak, very fine, subangular blocky structure; soft, very friable, slightly sticky and slightly plastic; 5 percent gravel; neutral; clear, wavy boundary.

B21t—8 to 21 inches, dark grayish-brown (10YR 4/2) silty clay loam, very dark grayish brown (10YR 3/2) moist; weak, medium, prismatic structure parting to weak, moderately fine and very fine, subangular blocky; slightly hard, very friable, sticky and plastic; 5 percent gravel; neutral; clear, wavy boundary.

B22t—21 to 36 inches, brown (10YR 5/3) clay loam, dark brown (10YR 4/3) moist; weak, fine, prismatic structure parting to moderate, fine, subangular blocky; slightly hard, very friable, sticky and plastic; common patchy clay films on faces of peds; 5 percent gravel; mildly alkaline; clear, wavy boundary.

Cca—36 to 60 inches, brown (10YR 5/3) clay loam, brown (10YR 5/3) moist; massive; slightly hard, very friable, sticky and plastic, 5 percent gravel; strong effervescence, moderately alkaline.

Depth to the calcareous substratum ranges from 20 to 40 inches. Content of coarse fragments ranges from 0 to 15 percent in the A horizon and B horizon and from 0 to 35 percent in the C horizon.

The A1 horizon has a value of 4 or 5 when dry and 2 or 3 when moist and a chroma of 2 or 3 when dry or moist. It is loam, silt loam, or silty clay loam. It is neutral or mildly alkaline.

The B21t horizon has a hue of 7.5YR or 10YR, a value of 4 or 5 when dry and 2 or 3 when moist, and a chroma of 2 or 3 when dry or moist. The B22t horizon has a hue of 7.5YR or 10YR, a value of 4 or 5 when dry and 3 or 4 when moist, and a chroma of 2 to 4 when dry or moist. It is clay loam or silty clay loam and is neutral or mildly alkaline.

The C horizon has a hue of 7.5YR or 10YR. It is clay loam, silty clay loam, loam, or silt loam.

Decross soils are mapped only in associations with Buckskin soils.

Dipman Series

The Dipman series consists of poorly drained soils that formed in alluvium on flood plains. The soils are nearly level, and slopes are 0 to 3 percent. Elevation ranges from 5,600 to 7,000 feet. Vegetation is mainly willow, rushes, sedges, and white clover. The average annual precipitation is 18 to 21 inches, the average annual temperature is about 42° F, and the frost-free season is 30 to 50 days.

In a representative profile the upper part of the surface layer is dark-gray silty clay loam about 11 inches thick. The lower part of the surface layer is brown silty clay that is mottled with dark brown and is about 6 inches thick. The subsoil is reddish-gray silty clay that is mottled with very dark gray and is about 12 inches thick. The substratum is gray very

gravelly loam to a depth of 60 inches or more and is mottled with dark brown. The profile is mildly alkaline.

Permeability is slow. Available water capacity, above the water table, is 3 to 4 inches. Effective rooting depth is about 60 inches. The seasonal high water table is at a depth of 7 to 20 inches. These soils are generally flooded annually for short periods in spring and early in summer.

These soils are used for native pasture, for native hay, and as wildlife habitat.

Representative profile of Dipman silty clay loam, in rangeland, about 2 miles southeast of Auburn and 60 feet northeast of the center of northwest quarter sec. 15, T. 32 N., R. 119 W., Lincoln County:

A11—0 to 11 inches, dark-gray (10YR 4/1) silty clay loam, black (10YR 2/1) moist; weak, coarse, subangular blocky structure parting to weak, very fine, subangular blocky; hard, friable, sticky and plastic; mildly alkaline; abrupt, wavy boundary.

A12g—11 to 17 inches, brown (7.5YR 5/2) silty clay, dark brown (7.5YR 3/2) moist; common, fine, distinct, dark-brown (7.5YR 4/4) mottles; weak, very fine, angular blocky structure; very hard, firm, very sticky and very plastic; mildly alkaline; gradual, wavy boundary.

B2g—17 to 29 inches, reddish-gray (5YR 5/2) silty clay, dark reddish gray (5YR 4/2) moist; many, coarse, distinct, very dark gray (5YR 3/1) mottles; massive; very hard, firm, very sticky and very plastic; mildly alkaline; clear, wavy boundary.

IICg—29 to 60 inches, gray (10YR 5/1) very gravelly loam, very dark gray (10YR 3/1) moist; many, fine, distinct, dark-brown (7.5YR 4/2) mottles; massive; hard, friable, sticky and plastic; 70 percent gravel and cobbles; mildly alkaline.

Depth to the very gravelly loam substratum ranges from 20 to 40 inches.

The A1 horizon has a hue of 7.5YR or 10YR, a value of 4 or 5 when dry and 2 or 3 when moist, and a chroma of 0 to 2 when dry or moist. Mottles generally occur in the lower part of the A1 horizon, but they can occur throughout. The A1 horizon is generally silty clay loam but is clay or silty clay in places. It is generally subangular blocky but is granular in places. It is hard to extremely hard, friable or firm, sticky or very sticky, and plastic or very plastic.

The B2g horizon has a value of 5 or 6 when dry and 4 or 5 when moist and a chroma of 1 or 2 when dry or moist. It is generally silty clay but is clay, silty clay loam, or clay loam in places. In some profiles this horizon is subangular blocky. The B2g horizon is hard or very hard, friable or firm, sticky or very sticky, and plastic or very plastic.

The content of gravel and cobbles in the IIC horizon ranges from 50 to 80 percent. Texture of the fine earth part is generally loam but ranges from sandy loam to clay loam.

Dipman silty clay loam (Dm).—This nearly level soil is on flood plains along the Salt River and some of its tributaries. Slope is 0 to 3 percent. The profile of this soil is the one described as representative of the series.

Included with this soil in mapping are areas of Narrows silty clay, Turson silt loam, Paulson silty clay loam, and soils that have a peaty surface layer, each of which makes up about 5 percent of the mapped areas.

Runoff is slow, and the hazard of erosion is slight.

This soil is used for native pasture, for native hay, and as wildlife habitat. Capability unit Vw–64 dryland; Wetland range site.

Dipman-Narrows association (DN).—This nearly level association is on flood plains along the Salt River and its tributaries. About 40 percent of this association is Dipman silty clay loam, 0 to 3 percent slopes, and about 30 percent is Narrows silty clay, 0 to 3 percent slopes. Included soils make up the remaining 30 percent. The profile of this Narrows soil is the one described as representative of the Narrows series.

Included with these soils in mapping are areas of Turson silt loam; Paulson silty clay loam, wet; and Valleono silty clay loam, wet.

Runoff is slow, and the hazard of erosion is slight.

This association is used for native pasture and native hay and as wildlife habitat. Dipman soil in capability unit Vw–64 dryland; Wetland range site. Narrows soil in capability unit Vw–64 dryland; Wetland range site.

Greyback Series

The Greyback series consists of somewhat excessively drained soils that formed in alluvium on alluvial fans and foot slopes. The soils are nearly level to very steep, and slopes are 0 to 60 percent. Elevation ranges from 5,800 to 7,500 feet. Vegetation is big sagebrush, serviceberry, Kentucky bluegrass, and basin wildrye. The average annual precipitation is 18 to 21 inches, the average annual temperature is about 46° F, and the frost-free season is 30 to 50 days.

In a representative profile the surface layer is grayish-brown gravelly loam about 7 inches thick. The subsoil is brown gravelly loam about 11 inches thick. The substratum is light yellowish-brown very gravelly sandy loam and very gravelly loamy sand or sand to a depth of 60 inches or more. The profile is mildly alkaline or moderately alkaline (fig. 4).

Permeability is moderate. Available water capacity, to a depth of 60 inches, is 3 to 6 inches. Effective rooting depth is 60 inches or more.

These soils are used for irrigated crops and pasture, for range, as wildlife habitat, and for townsites.

Representative profile of Greyback gravelly loam, in rangeland, about ½ mile east of Etna and about 420 feet east and 390 feet south of center of sec. 11, T. 35 N., R. 119 W., Lincoln County:

A1—0 to 7 inches, grayish-brown (10YR 5/2) gravelly loam, very dark grayish brown (10YR 3/2) moist; weak, fine, subangular blocky structure parting to moderate, fine, granular; slightly hard, very friable; 15 percent gravel; mildly alkaline; gradual, wavy boundary.

B2—7 to 18 inches, brown (10YR 5/3) gravelly loam, dark brown (10YR 4/3) moist; moderate, fine, subangular blocky structure; slightly hard, very friable; 25 percent gravel; slight effervescence; moderately alkaline; gradual, wavy boundary.

C1ca—18 to 28 inches, light yellowish-brown (10YR 6/4) very gravelly sandy loam, brown (10YR 5/3) moist; massive; slightly hard, very friable; 50 percent gravel; violent effervescence; secondary calcium carbonate as concretions and as coatings on gravel fragments; moderately alkaline; diffuse, wavy boundary.

IIC2ca—28 to 60 inches, very gravelly loamy sand or sand; strong effervescence; some secondary calcium carbonate as coatings on gravel fragments.

Depth to calcareous material ranges from 5 to 16 inches, and depth to very gravelly loamy sand or sand ranges from 20 to 40 inches.

The A1 horizon has a hue of 10YR or 2.5Y, a value of 4 or 5 when dry and 2 or 3 when moist, and a chroma of 2 or 3 when dry or moist. It is generally gravelly loam but is gravelly clay loam or cobbly loam in places. The content of coarse fragments in the A1 horizon ranges from 15 to 50 percent.

The B2 horizon has a hue of 10YR or 2.5Y, a value of 5 or 6 when dry and 4 or 5 when moist, and a chroma of 2 to 4 when dry or moist. It is generally gravelly loam but is

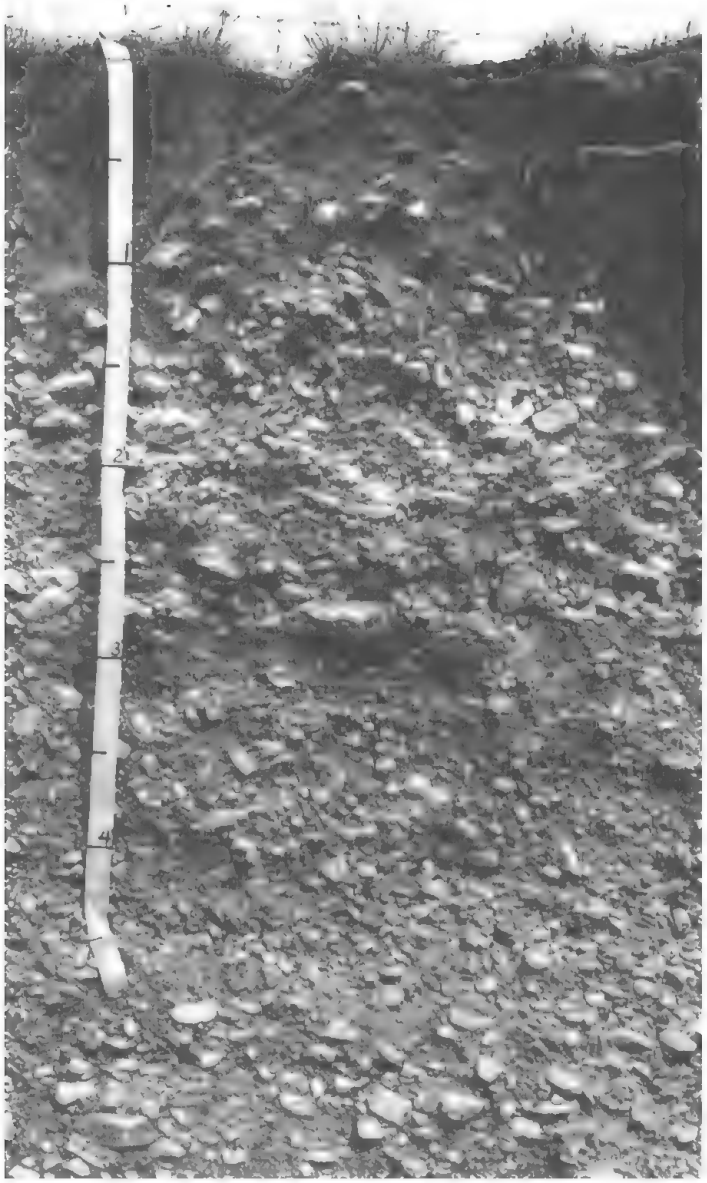


Figure 3.—Representative profile of Greyback gravelly loam.

gravelly clay loam in places. The content of coarse fragments in the B2 horizon ranges from 15 to 50 percent. In some profiles the B2 horizon is weak prismatic.

The C horizon has a hue of 10YR or 2.5Y. The content of coarse fragments in the C horizon ranges from 50 to 80 percent.

Greyback gravelly loam (Gg).—This nearly level to gently sloping soil is on alluvial fans, mainly in the lower valley. Slopes are 0 to 6 percent. The profile of this soil is the one described as representative of the series.

Included with this soil in mapping are areas of Greyback cobbly loam, which makes up 10 percent of the mapped areas, and small areas of Greyback gravelly loam, 6 to 10 percent slopes.

Runoff is slow, and the hazard of erosion is slight.

This soil is used for irrigated crops, for range, as wildlife habitat, and for townsites. Barley and alfalfa-bromegrass hay are the main crops. Capability units VIs–9 dryland and IVs–9 irrigated; Loamy range site.

Greyback and Hobacker soils, 0 to 30 percent slopes (GHE).—This undifferentiated group can consist of only one of the dominant soils or of two or more. The Greyback soils are mainly in the lower valley, and the Hobacker soils are mainly in the upper valley. About 25 percent of this undifferentiated group is Greyback gravelly loam, 0 to 30 percent slopes; about 25 percent is Hobacker gravelly loam, 0 to 30 percent slopes; about 15 percent is Greyback cobbly loam, 0 to 30 percent slopes (fig. 5); and about 15 percent is Hobacker cobbly loam, 0 to 30 percent slopes. Included soils make up the remaining 20 percent. The Greyback and Hobacker soils have profiles similar to the ones described as representative of their respective series, but the surface layer of the cobbly phase of each series is 20 to 35 percent cobbles.

Included with these soils in mapping are areas of Osmund gravelly loam, Osmund loam, and Thayne gravelly loam.

Figure 4.—Surface of a Greyback cobbly loam.

Runoff is slow to rapid, and the hazard of erosion is slight to high.

This undifferentiated group is mainly used for range and as wildlife habitat. Some small, less sloping areas are used for irrigated pasture. Greyback and Hobacker gravelly loams in capability unit VIe–1 dryland; Loamy range site. Greyback and Hobacker cobbly loams in capability unit VIe–1 dryland; Gravelly range site.

Greyback-Rooset association, hilly (GRD).—The Greyback soil and Rooset soil in this association are on upper parts of foot slopes, and the Decross soil is on lower parts of side slopes. About 30 percent of this association is Greyback gravelly loam, 10 to 30 percent slopes; about 30 percent is Rooset gravelly loam, 10 to 30 percent slopes; and about 30 percent is Decross loam, 10 to 30 percent slopes. Included soils make up the remaining 10 percent. The profiles of Greyback and Decross soils are similar to the ones described as representative of their respective series. The profile of this Rooset soil is the one described as representative of the Rooset series.

Included with these soils in mapping are areas of Robana silt loam and Willow Creek silt loam.

Runoff is medium to rapid, and the hazard of erosion is moderate to high.

This association is used for range and as wildlife habitat. Greyback soil in capability unit VIe–1 dryland; Loamy range site. Rooset soil in capability unit VIe–1 dryland; Loamy site. Decross soil in capability unit VIe–1 dryland; Loamy range site.

Greyback-Rooset association, steep (GRE).—The Greyback soil and Rooset soil in this association are on upper parts of foot slopes, and the Decross soil is on lower parts of side slopes. About 40 percent of this association is Greyback gravelly loam, 30 to 60 percent slopes; about 30 percent is Rooset gravelly loam, 30 to 60 percent slopes; and about 20 percent is Decross loam, 30 to 60 percent slopes. Included soils make up the remaining 10 percent. The profiles of these soils are similar to the ones described as representative of their respective series.

Included with these soils in mapping are areas of Robana silt loam.

Runoff is rapid, and the hazard of erosion is severe.

This association is used for range and as wildlife habitat. Greyback and Rooset soils in capability unit VIIe–1 dryland; Steep Stony range site. Decross soil in capability unit VIIe–1 dryland; Steep Loamy range site.

Hobacker Series

The Hobacker series consists of somewhat excessively drained soils. The soils formed in alluvium on fans and terraces and are nearly level to steep. Slopes are 0 to 30 percent. Elevation ranges from 5,800 to 7,500 feet. Vegetation is mainly big sagebrush, serviceberry, Kentucky bluegrass, basin wildrye, and thickspike wheatgrass. The average annual precipitation is 18 to 21 inches, the average annual temperature is about 43° F, and the frost-free season is 30 to 50 days.

In a representative profile the surface layer is grayish-brown to brown gravelly loam about 23 inches thick. The upper part of the substratum is brown very gravelly sandy loam about 7 inches thick. The lower part of the substratum is brown very gravelly loamy sand to a depth of 60 inches or more. The profile is mildly alkaline or moderately alkaline (fig. 6).

Permeability is moderate. Available water capacity, to a depth of 60 inches, is 3 to 6 inches. Effective rooting depth is 60 inches or more.

These soils are used for irrigated crops and pasture, dryland pasture, range, urban development, recreation, and wildlife habitat.

Representative profile of Hobacker gravelly loam, in rangeland, near the northwest corner of the Afton city limits, about 900 feet west and 20 feet north of the east quarter corner, sec. 25, T. 32 N., R. 119 W., Lincoln County (Laboratory data available):

A11—0 to 9 inches, grayish-brown (10YR 5/2) gravelly loam, very dark grayish brown (10YR 3/2) moist;

Figure 5.—Representative profile of Hobacker gravelly loam.

strong, fine, granular structure; soft, very friable; 20 percent gravel and cobbles; mildly alkaline; clear, smooth boundary.

A12—9 to 23 inches, brown (7.5YR 5/3) gravelly loam, dark brown (7.5YR 3/3) moist; moderate, fine, subangular blocky structure parting to moderate, fine, granular; slightly hard, very friable; 45 percent gravel and cobbles; weak coatings of secondary calcium carbonate on the underside of gravel fragments in the lower part; slight effervescence; moderately alkaline; gradual, wavy boundary.

IIC1ca—23 to 30 inches, brown (7.5YR 5/3) very gravelly sandy loam, dark cobbles; coatings of secondary calcium carbonate on gravel fragments and in seams and streaks; violent effervescence; moderately alkaline; gradual, wavy boundary.

IIC2ca—30 to 60 inches, brown (7.5YR 5/4) very gravelly loamy sand, dark brown (7.5YR 4/4) moist; single grained; loose; 85 percent gravel and cobbles; coatings of secondary calcium carbonate on gravel fragments; violent effervescence; moderately alkaline.

Depth to calcareous material ranges from 6 to 20 inches. Depth to the very gravelly loamy sand in the substratum ranges from 20 to 40 inches.

The A horizon has a hue of 10YR or 7.5YR, a value of 4 or 5 when dry and 2 or 3 when moist, and a chroma of 2 or 3 when dry or moist. Content of coarse fragments ranges from 20 to 50 percent.

The C horizon has a value of 5 or 6 when dry and 4 or 5 when moist and a chroma of 2 to 4 when dry or moist. Content of coarse fragments ranges from 50 to 90 percent.

Hobacker gravelly sandy loam (Hb).—This nearly level soil is on terraces along the Snake River. Slopes are 0 to 3 percent. The profile of this soil is similar to the one described as representative of the series, but the surface layer is 13 inches thick and is gravelly sandy loam, and the next 10 inches is very gravelly sandy loam.

Included with this soil in mapping are about 200 acres of a soil that has a surface layer of sandy loam, 10 to 20 inches thick, and a substratum of very gravelly loamy sand.

Runoff is slow, and the hazard of erosion is slight. Available water capacity to a depth of 60 inches is 2 to 4 inches.

This soil is used for irrigated pasture, range, and urban development. Capability units VIs–9 dryland and IVs–9 irrigated; Loamy range site.

Hobacker gravelly loam (Hc).—This nearly level to gently sloping soil is on alluvial fans and terraces, mainly in the upper valley. Slopes are 0 to 6 percent. The profile of this soil is the one described as representative of the series.

Included with this soil in mapping are areas of Osmund and Mundos gravelly loams, which make up about 15 percent of the mapped areas.

Runoff is slow, and the hazard of erosion is slight.

This soil is used for irrigated crops, range, urban development, and recreation. Barley and alfalfa-bromegrass hay are the main crops. Capability units VIs–9 dryland and IVs–9 irrigated; Loamy range site.

Hobacker cobbly loam (Hd).—This nearly level soil is on alluvial fans. Slopes are 0 to 3 percent. The profile of this soil is similar to the one described as representative of the series, but the surface layer is 15 to 20 percent cobbles.

Included with this soil in mapping are areas of Hobacker gravelly loam, which makes up about 10 percent of the mapped areas.

Runoff is slow, and the hazard of erosion is slight.

This soil is used for irrigated pasture and range. Capability units VIs–9 dryland and Vs–9 irrigated; Gravelly range site.

Hobacker-Osmund gravelly loams, 6 to 20 percent slopes (HgD).—The soils in this complex are in an intermingled pattern on small alluvial fans and foot slopes on the east side of Star Valley. About 40 percent of this complex is Hobacker gravelly loam, 6 to 20 percent slopes, and about 40 percent is Osmund gravelly loam, 6 to 20 percent slopes. Included soils make up the remaining 20 percent. The profile of the Hobacker soil is similar to the one described as representative of the Hobacker series. The profile of the Osmund soil is similar to the one described as representative of the Osmund series, but the surface layer and the upper part of the subsoil are gravelly loam.

Included with these soils in mapping are areas of soils that are gravelly loam in the upper part and very gravelly loam below a depth of 40 inches.

Runoff is medium, and the hazard of erosion is moderate.

This complex is used for range. Some small, less sloping areas are used for irrigated pasture. Capability unit VIe–1 dryland; Loamy range site.

Hobacker-Osmund gravelly loams, 20 to 30 percent slopes (HOE).—The soils in this complex are in an intermingled pattern on small alluvial fans and foot slopes on the east side of Star Valley. About 40 percent of this complex is Hobacker gravelly loam, 20 to 30 percent slopes; and about 40 percent is Osmund gravelly loam, 20 to 30 percent slopes. Included soils make up the remaining 20 percent. The profile of the Hobacker soil is similar to the one described as representative of the Hobacker series. The profile of the Osmund soil is similar to the one described as representative of the Osmund series, but the surface layer and the upper part of the subsoil are gravelly loam.

Included with these soils in mapping are areas of soils that are gravelly loam in the upper part and very gravelly loam below a depth of 40 inches.

Runoff is rapid, and the hazard of erosion is high.

This complex is used for range. Capability unit VIe–1 dryland; Loamy range site.

Huffine Series

The Huffine series consists of well-drained soils that formed in wind-deposited silt or alluvium on alluvial fans. The soils are nearly level to gently sloping, and slopes are 0 to 6 percent. Elevation ranges from 5,600 to 7,000 feet. Vegetation is mainly big sagebrush and grasses. The average annual precipitation is 18 to 21 inches, the average annual temperature is about 45° F, and the frost-free season is 30 to 50 days.

In a representative profile the surface layer is brown silt loam about 7 inches thick. The upper part of the subsoil is brown silt loam about 4 inches thick. The lower part of the subsoil is brown silty clay loam about 20 inches thick. The substratum is brown very gravelly loamy sand to a depth of 60 inches or more. The profile is neutral or mildly alkaline to a depth of about 31 inches and is moderately alkaline below that depth.

Permeability is moderate. Available water capacity,

to a depth of 60 inches, is 5 to 10 inches. Effective rooting depth is 60 inches or more.

These soils are used for irrigated crops, for range, and as wildlife habitat. They are suited to dryland crops.

Representative profile of Huffine silt loam, 0 to 3 percent slopes, in a cultivated area, about 3 miles north of Etna; about 240 feet west and 21 feet south of northeast corner of NW¼SW¼ sec. 26, T. 36 N., R. 119 W., Lincoln County:

Ap—0 to 7 inches, brown (10YR 5/3) silt loam, dark brown (10YR 3/3) moist; moderate, fine, subangular blocky structure parting to moderate, fine, granular; soft, very friable, slightly sticky and slightly plastic; neutral; clear, smooth boundary.

B1—7 to 11 inches, brown (10YR 5/3) silt loam, dark brown (10YR 3/3) moist; moderate, fine, subangular blocky structure; hard, friable, slightly sticky and slightly plastic; few, thin, glossy patches on faces of peds and in root channels; neutral; clear, smooth boundary.

B21t—11 to 23 inches, brown (10YR 5/3) silty clay loam, dark brown (10YR 4/3) moist; weak, fine, prismatic structure parting to strong, fine subangular blocky; hard, friable, sticky and plastic; many, thin, glossy patches on faces of peds; thin glossy coating on insides of root channels; few coatings of bleached sand and silt on ped faces; neutral; gradual, wavy boundary.

B22t—23 to 31 inches, brown (7.5YR 5/3) silty clay loam, dark brown (7.5YR 4/3) moist; moderate, fine, prismatic structure parting to moderate, fine, subangular blocky; hard, friable, sticky and plastic; many, thin, waxlike patches on faces of peds; waxlike coatings on insides of root channels; few coatings of bleached sand and silt grains on some peds; mildly alkaline; gradual, wavy boundary.

IICca—31 to 60 inches, brown (10YR 5/3) very gravelly loamy sand, dark brown (10YR 4/3) moist; massive; slightly hard, very friable; 70 percent gravel and cobble, much of which is limestone; secondary calcium-carbonate concretions and coatings on coarse fragments; violent effervescence; moderately alkaline.

Depth to very gravelly loamy sand ranges from 20 to 40 inches.

The A horizon has a hue of 10YR or 7.5YR, a value of 4 or 5 when dry and 2 or 3 when moist, and a chroma of 2 or 3 when dry or moist. It is generally silt loam but is silty clay loam in places. It is neutral or mildly alkaline.

The B2t horizon has a hue of 10YR or 7.5YR, a value of 5 or 6 when dry and 4 or 5 when moist, and a chroma of 3 or 4 when dry or moist. It is neutral or mildly alkaline.

The content of coarse fragments in the IIC horizon ranges from 60 to 90 percent.

Huffine silt loam, 0 to 3 percent slopes (HuA).—This nearly level soil is on alluvial fans. The profile of this soil is the one described as representative of the series.

Included with this soil in mapping are areas of Thayne loam and Robana silt loam, each of which makes up about 5 percent of the mapped areas.

Runoff is slow, and the hazard of erosion is slight.

This soil is used for irrigated crops, for range, and as wildlife habitat. It is suited to dryland crops. Barley and alfalfa-bromegrass hay are the main crops. Capability units IIIs–2 dryland and IIIs–2 irrigated; Loamy range site.

Huffine silt loam, 3 to 6 percent slopes (HuB).—This gently sloping soil is on alluvial fans. The profile of this soil is similar to the one described as representative of the series.

Included with this soil in mapping are small areas of Thayne loam and Robana silt loam, which make up about 15 percent of the mapped areas.

Runoff is slow, and the hazard of erosion is slight.

This soil is used for irrigated crops, for range, and as wildlife habitat. It is suited to dryland crops. Barley and alfalfa-bromegrass hay are the main irrigated crops. Capability units IIIe–2 dryland and IIIe–2 irrigated; Loamy range site.

Lail Series

The Lail series consists of well-drained soils that formed in alluvium derived from soft, sedimentary red beds on foot slopes. The soils are sloping to very steep, and slopes are 6 to 50 percent. Elevation ranges from 6,000 to 7,500 feet. Vegetation is mainly quaking aspen, lodgepole pine, Douglas-fir, pinegrass, snowberry, serviceberry, and Kentucky bluegrass. The average annual precipitation is 18 to 21 inches, the average annual temperature is about 40° F, and the frost-free season is 30 to 50 days.

In a representative profile about 3 inches of undecomposed and partly decomposed pine needles, twigs, bark, and cones cover a surface layer of dark grayish-brown silt loam about 1 inch thick. The upper part of the subsurface layer is pinkish-gray silt loam about 5 inches thick. The lower part of the subsurface layer is pinkish-gray and reddish-brown loam about 5 inches thick. The subsoil is reddish-brown clay about 27 inches thick. The substratum is reddish-brown clay loam to a depth of 60 inches or more. The profile is slightly acid or neutral to a depth of 31 inches and is moderately alkaline below that depth.

Permeability is slow. Available water capacity, to a depth of 60 inches, is 9 to 11 inches. Effective rooting depth is 60 inches or more.

These soils are used for grazed woodland and as wildlife habitat.

Representative profile of Lail silt loam, 30 to 50 percent slopes, in an area of Lail-Cowdrey association, in grazed woodland, about 5 miles west of Afton, in NW¼NW¼ sec. 32, T. 32 N., R. 119 W., Lincoln County:

O1—3 inches to 1 inch, undecomposed pine needles, twigs, bark, and cones.

O2—1 inch to 0, partly decomposed organic matter from O1 horizon.

A1—0 to 1 inch, dark grayish-brown (10YR 4/2) silt loam, dark brown (10YR 2/2) moist; moderate, fine, granular structure; soft, very friable, slightly sticky and slightly plastic; common, very fine roots; slightly acid; abrupt, smooth boundary.

A2—1 to 6 inches, pinkish-gray (7.5YR 7/2) silt loam, brown (7.5YR 5/2) moist; weak, medium, platy structure parting to weak, fine, granular; soft, very friable, slightly sticky and slightly plastic; common very fine roots; common very fine and fine tubular pores; slightly acid; clear, smooth boundary.

A&B—6 to 11 inches, mixed pinkish-gray (7.5YR 7/2) and reddish-brown (5YR 5/3) loam, brown (7.5YR 5/2) and reddish brown (5YR 4/3) moist; weak, medium and coarse, subangular blocky structure; hard, friable, sticky and plastic; few fine and medium roots; few fine tubular pores; horizon consists of matrix similar to A2 horizon and nodules and seams of material similar to B2t horizon; thin waxlike patches on faces of some peds; neutral; gradual, wavy boundary.

B2t—11 to 31 inches, reddish-brown (5YR 5/3) clay, reddish brown (5YR 4/3) moist; strong, medium, angular

blocky structure parting to strong, fine, angular blocky; very hard, firm, very plastic; few roots; few tubular pores; thin, continuous, waxlike coatings on faces of peds; waxlike coatings and fillings in root channels; a few shiny slickenside surfaces near the base horizon; neutral; gradual, wavy boundary.

B3ca—31 to 38 inches, reddish-brown (5YR 5/4) clay, reddish brown (5YR 4/4) moist; weak, coarse, angular blocky structure; very hard, firm, very plastic; thin, nearly continuous, waxlike coatings on faces of peds; thin, discontinuous, waxlike coatings in root channels; a few shiny slickenside surfaces; strong effervescence; visible secondary calcium carbonates as small concretions; moderately alkaline; gradual, wavy boundary.

C—38 to 60 inches, reddish-brown (5YR 5/4) clay loam, reddish brown (5YR 4/4) moist; massive; very hard, firm, sticky and plastic; strong effervescence; visible secondary calcium carbonate as small concretions and in seams and streaks; moderately alkaline.

The A2 horizon has a hue of 5YR or 7.5YR, a value of 6 or 7 when dry and 4 or 5 when moist, and a chroma of 2 or 3 when dry or moist. It is generally silt loam but is loam or silty clay loam in places. It is platy or subangular blocky and is slightly acid or neutral.

The B2t horizon has a hue of 2.5YR or 5YR, a value of 5 or 6 when dry and 4 when moist, and a chroma of 2 to 4 when dry or moist. It is generally clay but is clay loam, silty clay loam, or silty clay in places. It is neutral or slightly acid.

The C horizon has a hue of 2.5YR or 5YR, a value of 5 or 6 when dry and 4 when moist, and a chroma of 2 to 4 when dry or moist. Texture of the fine earth fraction in the C horizon is generally clay loam but is silty clay loam, silty clay, or clay in places. Coarse fragment content ranges from 0 to 35 percent.

Lail-Cowdrey association (LC).—The steep to very steep soils in this association are on foot slopes and hillsides that face north and east. About 50 percent of this association is Lail silt loam, 30 to 50 percent slopes; and about 30 percent is Cowdrey clay loam, 30 to 50 percent slopes. Included soils make up the remaining 20 percent. The profiles of the soils are similar to the ones described as representative of their respective series.

Included with these soils in mapping are areas of Paulson silty clay loam, Buckskin silt loam, and rock outcrop.

Runoff is rapid, and the hazard of erosion is high.

This association is used for grazed woodland and as wildlife habitat. Its suitability for the production of fenceposts, poles, and sawtimber is low to medium. Capability unit VIIe–1 dryland; not assigned to a range site.

Leavittville Series

The Leavittville series consists of well-drained soils that formed in alluvium on alluvial fans and terraces. The soils are nearly level, and slopes are 0 to 3 percent. Elevation ranges from 5,600 to 7,000 feet. Vegetation is dominantly big sagebrush, Kentucky bluegrass, and basin wildrye. The average annual precipitation is 18 to 21 inches, the average annual temperature is about 43° F, and the frost-free season is 30 to 50 days.

In a representative profile the surface layer is brown silt loam about 22 inches thick. The upper part of the substratum is pinkish-gray silt loam about 6 inches thick. The lower part of the substratum is pinkish-gray very gravelly loam to a depth of 60 inches or more. The soils are moderately alkaline.

Permeability is moderate. Available water capacity, to a depth of 60 inches, is 5 to 10 inches. Effective rooting depth is 60 inches or more.

These soils are used for irrigated crops and pasture and as wildlife habitat.

Representative profile of Leavittville silt loam, 0 to 3 percent slopes, in an area of Leavittville complex, in rangeland, about 3 miles west of Afton; approximately 100 feet north and 800 feet east of the southwest corner, sec. 27, T. 32 N., R. 119 W., Lincoln County:

A11—0 to 11 inches, brown (7.5YR 5/2) silt loam, very dark brown (7.5YR 2/2) moist; moderate, medium, subangular blocky structure parting to moderate, medium, granular; soft, very friable, sticky and slightly plastic; slight effervescence; moderately alkaline; gradual, wavy boundary.

A12—11 to 22 inches, brown (7.5YR 5/2) silt loam, dark brown (7.5YR 3/2) moist; moderate, fine, prismatic structure parting to moderate, medium, subangular blocky; hard, very friable, sticky and slightly plastic; few, thin, patchy, waxlike coatings on some vertical ped faces; slight effervescence; moderately alkaline; gradual, wavy boundary.

C1ca—22 to 28 inches, pinkish-gray (7.5YR 6/2) silt loam, dark brown (7.5YR 4/2) moist; weak, medium, subangular blocky structure; hard, very friable, sticky and slightly plastic; some secondary calcium carbonate occurring as concretions and in thin seams and streaks; violent effervescence; moderately alkaline; gradual, wavy boundary.

IIC2ca—28 to 60 inches, pinkish-gray (7.5YR 6/2) very gravelly loam, dark brown (7.5YR 4/2) moist; massive; hard, very friable; 75 percent gravel; some visible secondary calcium carbonate occurring as concretions, in thin seams and streaks, and as coatings on coarse fragments; violent effervescence; moderately alkaline.

Depth to calcareous material ranges from 0 to 15 inches, and depth to the very gravelly loam in the substratum ranges from 20 to 40 inches.

The A1 horizon has a hue of 7.5YR or 10YR, a value of 4 or 5 when dry and 2 or 3 when moist, and a chroma of 2 or 3 when dry or moist. It generally is silt loam but is loam or silty clay loam in places. The clay content in the A1 horizon ranges from 18 to 30 percent, and the gravel content ranges from 0 to 5 percent. The A1 horizon generally is moderately alkaline, but it is mildly alkaline in places.

A B2 horizon is in some profiles.

The C horizon has a hue of 7.5YR or 10YR, a value of 5 or 6 when dry and 4 or 5 when moist, and a chroma of 2 or 3 when dry or moist. The upper part of the C horizon generally is silt loam but is silty clay loam in places. The content of coarse fragments in the upper part of the C horizon is 0 to 15 percent. The lower part of the C horizon is very gravelly loam or very gravelly sandy loam. It is 50 to 75 percent coarse fragments. The C horizon is weak prismatic, subangular blocky, or massive.

Leavittville complex (Le).—The soils in this complex are in an intermingled pattern on alluvial fans and terraces. About 55 percent of this complex is Leavittville silt loam, 0 to 3 percent slopes, and about 30 percent is soils that are similar to this Leavittville soil but lack gravelly loam at a depth of 20 inches. Included soils make up the remaining 15 percent. The profile of the Leavittville soil is the one described as representative of the Leavittville series. Use and management are essentially the same for the two soils.

Included with this soil in mapping are areas of Osmund loam, Valleono silty clay loam, and Turson silt loam.

Runoff is slow, and the hazard of erosion is slight.

This complex is used for crops and pasture, for range, and as wildlife habitat. The main irrigated and dryland crops are barley and alfalfa-bromegrass hay. Capability units IIIs–2 dryland and IIIs–2 irrigated; Loamy range site.

Mundos Series

The Mundos series consists of well-drained soils that formed in alluvium on alluvial fans. The soils are nearly level to gently sloping, and slopes are 0 to 6 percent. Elevation ranges from 5,700 to 7,500 feet. Vegetation is dominantly Kentucky bluegrass and big sagebrush. The average annual precipitation is 18 to 21 inches, the average annual temperature is about 43° F, and the frost-free season is 30 to 50 days.

In a representative profile the surface layer is dark-brown gravelly loam about 18 inches thick. The subsoil is reddish-brown gravelly loam about 10 inches thick. The substratum is reddish-brown very gravelly loam to a depth of 60 inches or more. The profile is neutral to mildly alkaline in the upper 28 inches and is moderately alkaline below that depth.

Permeability is moderate. Available water capacity, to a depth of 60 inches, is 3 to 7 inches. Effective rooting depth is 60 inches or more.

These soils are used for irrigated crops, for range, and as wildlife habitat.

Representative profile of Mundos loam, in an area of Osmund and Mundos loams, 0 to 3 percent slopes, in a cultivated area, about 3 miles north of Afton, about 1,320 feet east of the west quarter corner, sec. 7, T. 32 N., R. 118 W., Lincoln County:

Ap—0 to 8 inches, dark-brown (7.5YR 4/2) gravelly loam, dark brown (7.5YR 3/2) moist; moderate, medium, subangular blocky structure parting to strong, fine, granular; slightly hard, very friable, slightly sticky and slightly plastic; many micro to fine roots and common medium roots; many very fine tubular and vesicular pores; neutral; clear, smooth boundary.

A12—8 to 18 inches, dark-brown (7.5YR 4/2) gravelly loam, dark brown (7.5YR 3/2) moist; weak, fine, subangular blocky structure; slightly hard, very friable, slightly sticky and slightly plastic; common very fine and fine roots and few medium roots; many very fine tubular and vesicular pores; neutral; gradual, smooth boundary.

B2—18 to 28 inches, reddish-brown (5YR 5/3) gravelly loam, reddish brown (5YR 4/3) moist; moderate, medium, subangular blocky structure parting to moderate, fine, subangular blocky; hard, friable, slightly sticky and slightly plastic; common very fine and fine roots and few medium and coarse roots; many very fine tubular and vesticular pores; a few, thin, glossy patches on faces of peds and some glossy coatings in root channels; mildly alkaline; clear, wavy boundary.

Cca—28 to 60 inches, reddish-brown (5YR 5/3) very gravelly loam, reddish brown (5YR 4/3) moist; massive; slightly hard, very friable; few very fine and fine roots; common very fine tubular and vesicular pores; 60 percent gravel and cobbles; strong effervescence; secondary calcium carbonate as small concretions and as coatings on gravel fragments; moderately alkaline.

Depth to calcareous material ranges from 15 to 30 inches.

The A horizon has a hue of 10YR to 5YR, a value of 4 or 5 when dry and 2 or 3 when moist, and a chroma of 2 or 3 when dry or moist. Content of coarse fragments in the A horizon ranges from 0 to 35 percent. The A horizon is neutral or mildly alkaline.

The B2 horizon has a hue of 5YR or 2.5YR, a value of 5 or 6 when dry and 4 or 5 when moist, and a chroma of 2 to 4 when dry or moist. It is generally gravelly loam but is gravelly clay loam in places. Content of coarse fragments in the B2 horizon ranges from 20 to 35 percent. The B2 horizon is generally subangular blocky but is prismatic in places. It is mildly alkaline or neutral.

The C horizon is generally very gravelly loam but is very gravelly clay loam in places. Content of coarse fragments in the C horizon ranges from 35 to 75 percent.

Mundos soils are mapped only in undifferentiated groups with Osmund soils.

Narrows Series

The Narrows series consists of poorly drained soils that formed in alluvium on flood plains. The soils are nearly level and have slopes of 0 to 3 percent. Elevation ranges from 5,600 to 7,000 feet. Vegetation is mainly willows, rushes, sedges, and white clover. The average annual precipitation is 18 to 21 inches, the average annual temperature is about 40° F, and the frost-free season is 30 to 50 days.

In a representative profile about 2 inches of undecomposed grass roots cover a surface layer of dark-gray silty clay about 8 inches thick. The subsoil is brown silty clay about 6 inches thick. The substratum is gray silty clay, clay loam, and gravelly clay loam to a depth of 60 inches or more. The profile is moderately alkaline.

Permeability is slow. Available water capacity is 3.0 to 3.5 inches in the layer above the water table. Effective rooting depth is about 60 inches. The seasonal high water table is at a depth of 5 to 20 inches. This soil is generally flooded annually for short periods in spring and early in summer.

These soils are used for native pasture and hay and as wildlife habitat.

Representative profile of Narrows silty clay, 0 to 3 percent slopes, in an area of Dipman-Narrows association, in a pasture, about 2 miles west of Grover, about 270 feet west and 230 feet south of bridge in NW¼ NW¼ sec. 3, T. 32 N., R. 119 W., Lincoln County:

O1—2 inches to 0, organic layer of undecomposed grass roots.

A11—0 to 5 inches, dark-gray (10YR 4/1) silty clay, black (10YR 2/1) moist; weak, fine, subangular blocky structure parting to strong, coarse, granular; hard, friable, very sticky and plastic; slight effervescence; many micro and very fine roots; common very fine tubular pores; moderately alkaline; clear, smooth boundary.

A12g—5 to 8 inches, dark-gray (10YR 4/1) silty clay, black (10YR 2/1) moist; common, distinct, dark yellowish-brown (10YR 4/6) mottles; moderate, medium, prismatic structure parting to strong, fine, angular blocky; very hard, friable, very sticky and very plastic; slight effervescence; many micro and very fine roots; common very fine tubular pores; many slickensides; moderately alkaline; clear, smooth boundary.

B2g—8 to 14 inches, brown (7.5YR 5/2) silty clay, dark brown (7.5YR 3/2) moist, common, medium, distinct, dark yellowish-brown (10YR 4/6) mottles; moderate, medium, prismatic structure parting to strong, fine, angular blocky; very hard, firm, very sticky and very plastic; slight effervescence; common micro and very fine roots; common fine tubular pores; many slickensides; many crack fillings of material from horizons above; moderately alkaline; clear, smooth boundary.

C1cag—14 to 20 inches, gray (2.5Y 5/1) silty clay, dark gray (2.5Y 4/1) moist; common, medium, distinct, dark yellowish-brown (10YR 4/6) mottles; weak, fine, angular blocky structure; very hard, firm, very sticky and plastic; violent effervescence; few micro

and very fine roots; few very fine tubular pores; seams and crack fillings of dark material from the A horizon; much secondary calcium carbonate as finely divided forms and in hard concretions 1 to 3 inches in diameter; moderately alkaline; gradual, wavy boundary.

C2cag—20 to 28 inches, gray (5Y 6/1) clay loam, gray (5Y 5/1) moist; common, medium, distinct, dark-brown (7.5YR 4/4) and black (10YR 2/1) mottles; massive; very hard, friable, very sticky and plastic; violent effervescence; much secondary calcium carbonate in finely divided marllike forms and in concretions 1 to 3 inches in diameter; moderately alkaline; gradual, wavy boundary.

C3cag—28 to 60 inches, mixed gray (5Y 5/1) and brown (7.5YR 5/2) gravelly clay loam, dark gray (5Y 4/1) and dark brown (7.5YR 5/2) moist; massive; hard, firm, very sticky and plastic; strong effervescence; some accumulation of secondary calcium carbonate but much less than in C2cag horizon; 20 percent gravel; moderately alkaline.

The dark surface material ranges from 7 to 19 inches in thickness. Depth to calcareous material ranges from 0 to 6 inches.

The A1 horizon has a hue of 2.5Y or 10YR, a value of 4 or 5 when dry and 2 or 3 when moist, and a chroma of 0 to 2 when dry or moist. It is mildly or moderately alkaline.

The B2g horizon has a hue of 2.5Y, 10YR, or 7.5YR, a value of 4 to 5 when dry and 3 or 4 when moist, and a chroma of 2 or 3 when dry or moist. Mottling in the B2g horizon is distinct or prominent. The B2g horizon is moderately or strongly alkaline.

The Cca horizon has a hue of 2.5Y or 5Y. It is moderately alkaline or strongly alkaline. Secondary carbonate concretions are not present in all profiles.

Narrows soils are mapped only in an association with Dipman soils.

Osmund Series

The Osmund series consists of well-drained soils that formed in alluvium on alluvial fans, terraces, and foot slopes and in colluvium on mountain side slopes. The soils are nearly level to very steep, and slopes are 0 to 60 percent. Elevation ranges from 5,700 to 7,500 feet. Vegetation is mainly big sagebrush, serviceberry, and basin wildrye. The average annual precipitation is 18 to 21 inches, the average annual temperature is 43° F, and the frost-free season is 30 to 50 days.

In a representative profile the surface layer is dark grayish-brown loam about 10 inches thick. The subsoil is brown gravelly loam about 20 inches thick. The substratum is light-brown very gravelly loam to a depth of 60 inches or more. The profile is neutral to a depth of 30 inches and moderately alkaline below that depth (fig. 7).

Permeability is moderate. Available water capacity, to a depth of 60 inches, is 4 to 9 inches. Effective rooting depth is 60 inches or more.

These soils are used for irrigated crops, for range, as wildlife habitat, and for recreation.

Representative profile of Osmund loam, in an area of Osmund and Mundos loams, 3 to 6 percent slopes, in rangeland, about 400 feet north of the southwest corner of sec. 7, T. 31 N., R. 118 W., Lincoln County:

A1—0 to 10 inches, dark grayish-brown (10YR 4/2) loam, very dark grayish brown (10YR 3/2) moist; strong, fine, crumb and granular structure; soft, very friable, nonsticky and nonplastic; 10 percent gravel and cobbles; neutral; clear, smooth boundary.

B21—10 to 20 inches, brown (7.5YR 4/3) gravelly loam, dark brown (7.5YR 3/3) moist; moderate, medium and fine, subangular blocky structure parting to moderate, medium, granular; slightly hard, very friable, slightly sticky and slightly plastic; 15 percent gravel and cobbles; few, thin, glossy patches on faces of peds; weak glossy patches in root channels; neutral; gradual, smooth boundary.

Figure 6.—Representative profile of an Osmund loam.

B22—20 to 30 inches, brown (7.5YR 5/3) gravelly loam, dark brown (7.5YR 4/3) moist; moderate, medium, subangular blocky structure parting to moderate, coarse, granular; hard, very friable, slightly sticky and slightly plastic; few, thin, glossy patches on faces of peds; 25 percent gravel and cobbles; neutral; clear, wavy boundary.

Cca—30 to 60 inches, light-brown (7.5YR 6/3) very gravelly loam, dark brown (7.5YR 4/3) moist; massive; slightly hard, very friable, slightly sticky and slightly plastic; 55 percent gravel and cobbles; strong effervescence; secondary calcuim carbonate as concretions and as coatings on rock fragments; moderately alkaline.

The solum ranges from 20 to 40 inches in thickness. Depth to calcareous material ranges from 15 to 40 inches.

The A horizon has a hue of 10YR or 7.5YR, a value of 4 or 5 when dry and 2 or 3 when moist, and a chroma of 1 to 3 when dry or moist. It is loam or silt loam. Content of gravel in the A horizons ranges from 0 to 35 percent. The A horizon is granular, crumb, or subangular blocky and is neutral or mildly alkaline.

The B21 horizon has a hue of 7.5 YR or 10YR, a value of 4 or 5 when dry and 2 or 3 when moist, and a chroma of 2 or 3 when dry or moist. The B22 horizon has a hue of 7.5YR or 10YR, a value of 5 or 6 when dry and 4 or 5 when moist, and a chroma of 2 to 4 when dry or moist. It is loam, silt loam, or clay loam. Content of gravel in the B2 horizon ranges from 0 to 35 percent. The B2 horizon is prismatic or subangular blocky and is neutral or mildly alkaline.

The Cca horizon has a hue of 7.5YR or 10YR. It is gravelly loam, very gravelly loam, gravelly clay loam, or very gravelly clay loam. Content of gravel in the Cca horizon ranges from 35 to 80 percent, and content of cobble ranges from 5 to 15 percent.

Osmund and Mundos loams, 0 to 3 percent slopes (OmA).—About 45 percent of this undifferentiated group is Osmund loam, 0 to 3 percent slopes, and about 40 percent is Mundos loam, 0 to 3 percent slopes. Included soils make up the remaining 15 percent. Some mapped areas are only the Osmund soil, some are only the Mundos soil, and some are both soils. The profile of the Osmund soil is similar to the one described as representative of the Osmund series. The profile of the Mundos soil is similar to the one described for the Mundos series, but the surface layer is loam.

Included with these soils in mapping are areas of Osmund gravelly loam, Mundos gravelly loam, and Leavittville silt loam.

Runoff is slow, and the hazard of erosion is slight. Available water capacity is 4 to 9 inches in the Osmund soil and is 4 to 7 inches in the Mundos soil.

This undifferentiated group is used mainly for irrigated barley and alfalfa-bromegrass hay. It is suited to dryland crops. It is also used for range, as wildlife habitat, and for recreation (fig. 8). Capability units IIIs–2 dryland and IIIs–2 irrigated; Loamy range site.

Osmund and Mundos loams, 3 to 6 percent slopes (OmB).—About 40 percent of this undifferentiated group is Osmund loam, 3 to 6 percent slopes, and about 40 percent is Mundos loam, 3 to 6 percent slopes. Some mapped areas are Osmund loam only, some are Mundos loam only, and some are both. The profile of Osmund soil is the one described as representative of the Osmund series. The profile of the Mundos soil is similar to the one described as representative of the Mundos series, but the surface layer is loam.

Included with these soils in mapping are areas of Osmund gravelly loam and Mundos gravelly loam.

Runoff is slow, and the hazard of erosion is slight. Available water capacity is 4 to 9 inches in the Osmund soil and is 3.5 to 7 inches in the Mundos soil.

This undifferentiated group is used mainly for irrigated barley and alfalfa-bromegrass hay. It is also used for range and as wildlife habitat. It is suited to dryland crops. Capability units IIIe–2 dryland and IIIe–2 irrigated; Loamy range site.

Osmund and Mundos gravelly loams, 0 to 3 percent

Figure 7.—**Golf course on Osmund and Mundos loams, 0 to 3 percent slopes.**

slopes (OnA).—About 40 percent of this undifferentiated group is Osmund gravelly loam, 0 to 3 percent slopes, and about 40 percent is Mundos gravelly loam, 0 to 3 percent slopes. Included soils make up the remaining 20 percent. Some mapped areas are only Osmund gravelly loam, some are only Mundos gravelly loam, and some are both. The profile of the Osmund soil is similar to the one described as representative of the Osmund series, but the surface layer and the upper part of the subsoil are gravelly loam. The profile of the Mundos soil is the one described as representative of the Mundos series.

Included with these soils in mapping are areas of Hobacker gravelly loam and Osmund and Mundos loams.

Runoff is slow, and the hazard of erosion is slight. Available water capacity is 4 to 9 inches in the Osmund soil and is 3 to 6 inches in the Mundos soil.

This undifferentiated group is mainly used for irrigated barley and alfalfa-bromegrass hay. It is also used for range and as wildlife habitat. It is suited to dryland crops. Capability units IIIs–2 dryland and IIIs–2 irrigated; Loamy range site.

Osmund and Mundos gravelly loams, 3 to 6 percent slopes (OnB).—About 45 percent of this undifferentiated group is Osmund gravelly loam, 3 to 6 percent slopes, and about 40 percent is Mundos gravelly loam, 3 to 6 percent slopes. Included soils make up the remaining 15 percent. Some mapped areas are only Osmund gravelly loam, some are only Mundos gravelly loam, and some are both. The profile of the Osmund soil is similar to the one described as representative of the Osmund series, but the surface layer and the upper part of the subsoil are gravelly loam. The profile of the Mundos soil is similar to the one described as representative of the Mundos series.

Included with these soils in mapping are areas of Hobacker gravelly loam.

Runoff is slow, and the hazard of erosion is slight. Available water capacity is 4 to 9 inches in the Osmund soil and is 3 to 6 inches in the Mundos soil.

This undifferentiated group is mainly used for irrigated barley and alfalfa-bromegrass hay. It is also used for range and as wildlife habitat. It is suited to dryland crops. Capability units IIIe–2 dryland and IIIe–2 irrigated; Loamy range site.

Paulson Series

The Paulson series consists of well-drained soils that formed in alluvium on alluvial fans, terraces, and mountain foot slopes. The soils are nearly level to very steep, and slopes range from 0 to 60 percent. Elevation ranges from 5,800 to 7,500 feet. Vegetation is mainly big sagebrush, serviceberry, snowberry, Kentucky bluegrass, bluebunch wheatgrass, and basin wildrye. The average annual precipitation is 18 to 21 inches, the average annual temperature is about 43° F, and the frost-free season is 30 to 50 days.

In a representative profile the surface layer is dark reddish-gray silt loam about 5 inches thick. The upper part of the subsoil is dark reddish-gray silty clay loam about 5 inches thick. The next part of the subsoil is dark reddish-gray and reddish-brown silty clay about 24 inches thick. The lower part of the subsoil is reddish-brown silty clay loam about 7 inches thick. The substratum is light reddish-brown silt loam to a depth of 60 inches or more. The profile is neutral to a depth of 34 inches and is moderately alkaline below that depth.

Permeability is moderately slow. Available water capacity, to a depth of 60 inches, is 7 to 11 inches. Effective rooting depth is 60 inches or more.

These soils are used for irrigated and dryland crops, for range, and as wildlife habitat.

Representative profile of Paulson silty clay loam, 0 to 3 percent slopes, in rangeland, about 2 miles southwest of Fairview in NW¼SW¼ sec. 17, T. 31 N., R. 119 W., Lincoln County (Laboratory data available):

A1—0 to 5 inches, dark reddish-gray (5YR 4/2) silty clay loam, dark reddish brown (5YR 2/2) moist; strong, fine, crumb and granular structure; soft, very friable, sticky and plastic; neutral; clear, smooth boundary.

B1—5 to 10 inches, dark reddish-gray (5YR 4/2) silty clay loam, dark reddish brown (5YR 2/2) moist; moderate, fine, subangular blocky structure parting to strong, fine, granular; slightly hard, very friable, sticky and plastic; neutral; clear, smooth boundary.

B21t—10 to 27 inches, dark reddish-gray (5YR 4/2) silty clay, dark reddish brown (5YR 3/2) moist; strong, fine, prismatic structure parting to strong, fine, angular blocky; very hard, friable, very sticky and very plastic; thin, continuous, waxlike coatings on faces of peds; waxlike coatings and fillings in root channels and pores; neutral; clear, smooth boundary.

B22t—27 to 34 inches, reddish-brown (5YR 5/3) silty clay, dark reddish brown (5YR 3/3) moist; strong, fine, prismatic structure parting to strong, fine, angular blocky; extremely hard, friable, very sticky and very plastic; thin, continuous, waxlike coatings on the surface of peds; continuous waxlike coatings and fillings in root channels and pores; neutral; clear, wavy boundary.

B3—34 to 41 inches, reddish-brown (5YR 5/3) silty clay loam, reddish brown (5YR 4/3) moist; moderate, medium, prismatic structure parting to moderate, fine, angular blocky; very hard, friable, sticky and plastic; strong effervescence; thin waxlike patches on faces of peds; some waxlike coatings in root channels; moderately alkaline; gradual, wavy boundary.

Cca—41 to 60 inches, light reddish-brown (2.5YR 6/3) silt loam, reddish brown (2.5YR 4/3) moist; massive; hard, friable, slightly sticky and slightly plastic; violent effervescence; secondary calcium carbonate as concretions and in thin seams and streaks; moderately alkaline.

Depth to calcareous material is 15 to 40 inches. Content of coarse fragments ranges from 0 to 15 percent.

The A1 horizon has a hue of 5YR or 7.5YR, a value of 4 or 5 when dry and 2 or 3 when moist, and a chroma of 1 to 3 when dry or moist. It is silt loam, silty clay loam, or silty clay. It is generally crumb or granular but is subangular blocky in places.

The B2t horizon has a hue of 5YR to 2.5YR, a value of 4 or 5 when dry and 3 when moist, and a chroma of 2 or 3 when dry or moist. It is generally silty clay but is silty clay loam in places.

The C horizon has a hue of 5YR or 2.5YR. It is generally silt loam but is silty clay loam or silty clay in places.

Paulson silty clay loam, 0 to 3 percent slopes (PaA).—This nearly level soil is on alluvial fans and terraces. The profile of this soil is the one described as representative of the series.

Included with this soil in mapping are areas of Paulson silty clay loam that has a water table at a depth of 48 inches and areas of soils that are silt loam to a

depth of 60 inches or more, each of which makes up about 10 percent of the mapped areas.

Runoff is slow, and the hazard of erosion is slight.

This soil is used for irrigated crops and range. It is suited to dryland crops. Barley and alfalfa-bromegrass hay are the main crops. Capability units IIIc–1 dryland and IIIc–1 irrigated; Loamy range site.

Paulson silty clay loam, 3 to 6 percent slopes (PaB).—This gently sloping soil is on alluvial fans. The profile of this soil is similar to the one described as representative of the series.

Included with this soil in mapping are areas of soils that are silt loam to a depth of 60 inches or more. These soils make up 10 percent of the mapped areas.

Runoff is slow to medium, and the hazard of erosion is slight to moderate.

This soil is used for irrigated and dryland crops and range. Barley and alfalfa-bromegrass hay are the main crops. Capability units IIIe–1 dryland and IIIe–1 irrigated; Loamy range site.

Paulson silty clay loam, 6 to 10 percent slopes (PaC).—This sloping soil is on alluvial fans. The profile of this soil is similar to the one described as representative of the series.

Included with this soil in mapping and making up about 10 percent of the mapped areas are soils that are silt loam to a depth of 60 inches or more.

Runoff is medium to rapid, and the hazard of erosion is moderate to high.

This soil is used for dryland crops, for range, and as wildlife habitat. Barley and alfalfa-bromegrass hay are the main crops. Capability unit IIIe–1 dryland; Loamy range site.

Paulson silty clay loam, 10 to 20 percent slopes (PaD).—This moderately steep soil is on alluvial fans. The profile of this soil is similar to the one described as representative of the series.

Included with this soil in mapping are areas of deep, gravelly loams, which make up about 10 percent of the mapped areas, and areas of deep gravelly clay loams, which make up about 5 percent.

Runoff is rapid, and the hazard of erosion is high.

This soil is used for dryland crops, for range, and as wildlife habitat. Barley and alfalfa-bromegrass hay are the main crops. Capability unit IVe–1 dryland; Loamy range site.

Paulson-Rock land complex, 30 to 60 percent slopes (PKF).—The steep to very steep soils of this complex are in an intermingled pattern on mountain slopes. About 40 percent of this complex is Paulson silty clay loam, 30 to 60 percent slopes, and about 35 percent is Stony rock land. Included soils make up the remaining 25 percent. The profile of the Paulson soil is similar to the one described as representative of the series.

Included with these soils in mapping are areas of deep, stony and gravelly loams and clay loams; areas of shallow silty clay loams; and areas of Lail silt loam.

Runoff is rapid on the Paulson soil, and the hazard of erosion is high. Runoff is rapid on Stony rock land, and the hazard of erosion on the colluvial part is high.

This complex is used for range and as wildlife habitat. Capability unit VIIe–1 dryland; Paulson soil in Steep Loamy range site and Stony rock land in Very Shallow range site.

Paulson-Lail association (PL).—The Paulson soil in this association is on mountain slopes that face south and west, and the Lail soil is on foot slopes that face north. About 50 percent of this association is Paulson silty clay loam, 6 to 30 percent slopes, and about 20 percent is Lail silt loam, 6 to 30 percent slopes. Included soils make up the remaining 20 percent. The profiles of the Paulson soil and the Lail soil are similar to the ones described as representative of their respective series.

Included with these soils in mapping are areas of Stony rock land, areas of shallow silty clay loams, and areas of deep gravelly loams and clay loams.

Runoff is medium to rapid on the Paulson soil, and the hazard of erosion is moderate to high. Runoff is slow to rapid on the Lail soil, and the hazard of erosion is slight to high.

This association is used mainly as wildlife habitat. The Paulson soil is used for range, and the Lail soil is used for grazed woodland. The suitability of the Lail soil for the production of fenceposts, poles, and sawtimber is low to medium. Capability unit VIe–1 dryland; Paulson soil in Loamy range site and Lail soil not assigned to a range site.

Paulson-Osmund association (PO).—This steep to very steep association is on mountain slopes. About 45 percent of it is Paulson silty clay loam, 30 to 60 percent slopes, and about 35 percent is Osmund gravelly loam, 30 to 60 percent slopes. Included soils make up the remaining 20 percent. The profile of the Paulson soil is similar to the one described as representative of the Paulson series. The profile of the Osmund soil is similar to the one described as representative of the series, but the surface layer and the upper part of the subsoil are gravelly loam.

Included with these soils in mapping are areas of Stony rock land and areas of deep gravelly loam soils.

Runoff is rapid, and the hazard of erosion is high.

This association is used for range and as wildlife habitat. Capability unit VIIe–1 dryland; Steep Loamy range site.

Paulson-Robana association, hilly (PRD).—The Paulson soil in this association is on lower side slopes, the Robana soil is on the upper part of mountain side slopes, and the Buckskin soil is on ridgetops and the upper part of mountain side slopes. About 35 percent of this association is Paulson silty clay loam, 10 to 20 percent slopes; about 30 percent is Robana silt loam, 10 to 20 percent slopes; and about 25 percent is Buckskin silt loam, 10 to 20 percent slopes. Included soils make up the remaining 10 percent. The profile of the Paulson soil is similar to the one described as representative of the Paulson series. The profiles of the Robana soil and the Buckskin soil are similar to the ones described as representative of their respective series.

Included with these soils in mapping are areas of Decross loam.

Runoff on the Paulson soil is rapid, and the hazard of erosion is high. Runoff on the Robana soil and the Buckskin soil is medium, and the hazard of erosion is moderate.

This association is used for dryland crops, for range, and as wildlife habitat. Barley and alfalfa-bromegrass hay are the main crops. Paulson and Buckskin soils in capability unit IVe–1 dryland; Loamy range site. Ro-

bana soil in capability unit IVe–2 dryland; Loamy range site.

Paulson-Robana association, steep (PRE).—The Paulson soil in this association is on lower side slopes, the Robana soil is on the upper part of mountain side slopes, and the Buckskin soil is on ridgetops and the upper part of mountain side slopes. About 30 percent of this association is Paulson silty clay loam, 20 to 30 percent slopes, about 25 percent is Robana silt loam, 20 to 30 percent slopes, and about 25 percent is Buckskin silt loam, 20 to 30 percent slopes. Included soils make up the remaining 20 percent. The profiles of the Paulson and Robana soils are similar to the ones described as representative of their respective series.

Included with these soils in mapping are areas of Decross loam and areas of deep silty clay soils.

Runoff is rapid, and the hazard of erosion is high.

This association is used for dryland crops, for range, and as wildlife habitat. Alfalfa-bromegrass hay is the main crop. Capability unit VIe–1 dryland; Loamy range site.

Redmanson Series

The Redmanson series consists of well-drained soils that formed in colluvium on mountain slopes. The soils are steep to very steep, and slopes are 30 to 70 percent. Elevation ranges from 6,000 to 8,000 feet. Vegetation is mainly Douglas-fir, lodgepole pine, snowberry, and pinegrass. The average annual precipitation is 18 to 21 inches, the average annual temperature is 40° to 43° F, and the frost-free season is 30 to 50 days.

In a representative profile 1 inch of partly decayed fir and pine needles overlies a surface layer of dark-brown very gravelly silty clay loam about 10 inches thick. The upper part of the substratum is brown very gravelly silty clay loam about 34 inches thick. The lower part of the substratum is light-gray very gravelly silty clay loam to a depth of 60 inches or more. The profile is moderately alkaline.

Permeability is moderate. Available water capacity, to a depth of 60 inches, is 2 to 5 inches. Effective rooting depth is 60 inches or more.

These soils are used for grazed woodland, for range, and as wildlife habitat.

Representative profile of Redmanson very gravelly silty clay loam, 30 to 70 percent slopes, in an area of Redmanson association, in woodland, in mouth of Swift Creek Canyon in the northeast corner of SE¼SE¼ sec. 30, T. 32 N., R. 118 W., Lincoln County:

O1—1 inch to 0, mat of partly decayed fir and pine needles.

A1—0 to 10 inches, dark-brown (10YR 4/3) very gravelly silty clay loam, dark brown (10YR 3/3) moist; weak, fine, granular structure; soft, very friable, sticky and plastic; about 60 percent limestone fragments; strong effervescence; moderately alkaline; clear, wavy boundary.

C1—10 to 44 inches, brown (10YR 5/3) very gravelly silty clay loam, dark grayish brown (10YR 4/2) moist; massive; soft, very friable, sticky and plastic; about 75 percent limestone fragments; strong effervescence; moderately alkaline; gradual, wavy boundary.

C2—44 to 60 inches, light-gray (2.5YR 7/2) very gravelly silty clay loam, grayish brown (2.5Y 5/2) moist; massive; slightly hard, friable, sticky and plastic; few fine to coarse roots; about 75 percent limestone fragments; violent effervescence; moderately alkaline.

Depth to calcareous material ranges from 0 to 4 inches. Content of coarse fragments ranges from 50 to 80 percent. The profile is very gravelly silty clay loam or very gravelly silt loam.

The A1 horizon has a hue of 10YR or 2.5Y, a value of 4 or 5 when dry and 2 or 3 when moist, and a chroma of 2 or 3 when dry or moist. It is granular or subangular blocky.

The C horizon has a hue of 10YR or 2.5Y, a value of 5 to 7 when dry and 4 or 5 when moist, and a chroma of 2 or 3 when dry or moist. Secondary calcium carbonate crusts occur on the underside of some coarse fragments.

Redmanson association (RD).—The steep to very steep soils of this association are on forested mountain side slopes that face north. About 40 percent of this association is Redmanson very gravelly silty clay loam, 30 to 70 percent slopes, and about 40 percent is soils that are similar to this Redmanson soil but have a surface layer of gravelly loam, are redder, are noncalcareous to a depth of 24 inches or more, and formed in colluvium derived from sandstone. Included soils make up the remaining 20 percent. The profile of the Redmanson soil is the one described as representative of the Redmanson series. Use and management are essentially the same for the two soils.

Included with these soils in mapping are areas of Stony rock land, Lail silt loam, and deep, light-colored very stony and gravelly soils.

Runoff is rapid, and the hazard of erosion is high.

This association is used for grazed woodland and as wildlife habitat. Suitability of the soils for the production of fenceposts, poles, and sawtimber is low. Capability unit VIIe–1 dryland; not assigned to a range site.

Redmanson-Starley association (RE).—The Redmanson soil in this association is on mountain side slopes, and the Starley soil is on ridgetops. About 40 percent of this association is Redmanson very gravelly silty clay loam, 30 to 60 percent slopes, and about 30 percent is Starley cobbly silty clay loam, 30 to 60 percent slopes. Included soils make up the remaining 30 percent. The profiles of the soils are similar to the ones described as representative of their respective series.

Included with these soils in mapping are areas of very gravelly clay loam and Buckskin silt loam.

Runoff is rapid, and the hazard of erosion is high.

This association is used for range and as wildlife habitat. The vegetation is big sagebrush, bitterbrush, Rocky Mountain juniper, mountainmahogany, and Indian ricegrass. Redmanson soil in capability unit VIIe–1 dryland; Steep Stony range site. Starley soil in capability unit VIIe–1 dryland; Shallow Loamy range site.

Robana Series

The Robana series consists of well-drained soils that formed in wind-deposited silt on uplands. The soils are nearly level to steep, and slopes are 0 to 30 percent. Elevation ranges from 5,800 to 7,500 feet. Vegetation is mainly big sagebrush, serviceberry, Kentucky bluegrass, and bluebunch wheatgrass. The average annual precipitation is 18 to 21 inches, the average annual temperature is about 43° F, and the frost-free season is 30 to 50 days.

In a representative profile the surface layer is dark

grayish-brown silt loam about 15 inches thick. The upper part of the subsoil is brown silt loam and silty clay loam about 37 inches thick. The lower part of the subsoil is light yellowish-brown silt loam about 8 inches thick. The substratum is light yellowish-brown silt loam to a depth of 80 inches or more. The profile is neutral.

Permeability is moderate. Available water capacity, to a depth of 60 inches, is 11 to 13 inches. Effective rooting depth is 60 inches or more.

These soils are used for irrigated and dryland crops, for range, and as wildlife habitat.

Representative profile of Robana silt loam, 3 to 10 percent slopes, in rangeland, about 2 miles east of Freedom and about 1,700 feet east of the northwest corner of sec. 35, T. 35 N., R. 119 W., Lincoln County (Laboratory data available):

A11—0 to 6 inches, dark grayish-brown (10YR 4/2) silt loam, very dark brown (10YR 2/2) moist; moderate, fine, crumb structure; soft, very friable, nonsticky and slightly plastic; neutral; clear, smooth boundary.

A12—6 to 15 inches, dark grayish-brown (10YR 4/2) silt loam, very dark brown (10YR 2/2) moist; weak, medium, subangular blocky structure parting to moderate, medium, granular; slightly hard, very friable, slightly sticky and slightly plastic; neutral; clear, smooth boundary.

B1—15 to 20 inches, brown (10YR 5/3) silt loam, dark brown (10YR 3/3) moist; moderate, medium, prismatic structure parting to moderate, medium, subangular blocky; hard, very friable, slightly sticky and slightly plastic; few, thin, waxlike patches on faces of peds; weak gray coatings of bleached sand and silt on faces of peds; neutral; gradual, smooth boundary.

B21t—20 to 33 inches, brown (7.5YR 5/3) silty clay loam, dark brown (7.5YR 4/3) moist; moderate, fine, prismatic structure parting to strong, fine, angular and subangular blocky; hard, friable, sticky and plastic; moderate, continuous, waxlike coatings on faces of peds; waxlike coatings in channels; distinct gray coatings on faces of peds; neutral; gradual, smooth boundary.

B22t—33 to 52 inches, brown (7.5YR 5/3) silty clay loam, dark brown (7.5YR 4/3) moist; moderate, medium, prismatic structure parting to moderate, medium, subangular blocky; very hard, friable, sticky and plastic; moderate, continuous, waxlike coatings in root channels; weak gray coatings of bleached sand and silt; neutral; gradual, smooth boundary.

B3—52 to 60 inches, light yellowish-brown (10YR 6/4) silt loam, yellowish brown (10YR 5/4) moist; moderate, medium, subangular blocky structure; very hard, friable, slightly sticky and slightly plastic; few waxlike patches on faces of peds; scattered waxlike coatings in root channels; neutral; gradual, smooth boundary.

C—60 to 80 inches, light yellowish-brown (10YR 6/4) silt loam, yellowish brown (10YR 5/4) moist; massive; hard, friable, slightly sticky and slightly plastic; neutral.

The solum is more than 50 inches thick. Content of coarse fragments ranges from 0 to 5 percent.

The A horizon has a hue of 10YR or 7.5YR, a value of 4 or 5 when dry and 2 or 3 when moist, and a chroma of 2 or 3 when dry or moist.

The B2t horizon has a hue of 7.5YR to 10YR, a value of 5 or 6 when dry and 3 to 5 when moist, and a chroma of 3 or 4 when dry or moist. It is neutral or mildly alkaline.

The C horizon has a hue of 10YR or 7.5YR.

Robana silt loam, 0 to 3 percent slopes (RoA).—This nearly level soil is on uplands. The profile of this soil is similar to the one described as representative of the series.

Included with this soil in mapping are areas of Huffine silt loam, which makes up about 10 percent of the mapped areas.

Runoff is slow, and the hazard of erosion is slight.

This soil is used for irrigated and dryland crops and range. Barley and alfalfa-bromegrass hay are the main crops. Capability units IIIc–2 dryland and IIIc–2 irrigated; Loamy range site.

Robana silt loam, 3 to 10 percent slopes (RoC).—This gently sloping to sloping soil is on uplands. The profile of this soil is the one described as representative of the series.

Included with this soil in mapping are areas of Willow Creek silt loam and areas of Huffine silt loam, each of which makes up about 5 percent of the mapped areas.

Runoff is slow to medium, and the hazard of erosion is slight to moderate.

This soil is used for irrigated and dryland crops, for range, and as wildlife habitat. Barley and alfalfa-bromegrass hay are the main crops. Capability units IIIe–2 dryland and IVe–2 irrigated; Loamy range site.

Robana silt loam, 10 to 20 percent slopes (RoD).—This moderately steep soil is on uplands. The profile of this soil is similar to the one described as representative of the series.

Included with this soil in mapping are areas of Willow Creek silt loam, which makes up about 10 percent of the mapped areas, and areas of Bozeman silt loam, which makes up about 5 percent.

Runoff is medium, and the hazard of erosion is moderate.

This soil is mainly used for dryland crops, for range, and as wildlife habitat. Some small, less sloping areas are used for irrigated crops. Barley and alfalfa-bromegrass hay are the main crops. Capability unit IVe–2 dryland; Loamy range site.

Robana-Turnerville association, undulating (RTC).—The gently sloping to sloping soils of this association are on uplands. The Robana soil is on slopes that face south and west, and the Turnerville soil is on slopes that face north and east. About 45 percent of this association is Robana silt loam, 3 to 10 percent slopes, and about 40 percent is Turnerville silt loam, 3 to 10 percent slopes. Included soils make up the remaining 15 percent. The profiles of the Robana and Turnerville soils are similar to the ones described as representative of their respective series.

Included with these soils in mapping are areas of Decross loam and areas of a Turnerville soil that has a surface layer of very fine sandy loam.

Runoff is slow to medium, and the hazard of erosion is slight to moderate.

This association is mainly used for irrigated and dryland crops, as wildlife habitat, and for recreation (fig. 9). Barley and alfalfa-bromegrass hay are the main crops. The Robana soil is also used for range, and forested areas of the Turnerville soil are used for grazed woodland. The suitability of the Turnerville soil for the production of fenceposts, poles, and sawtimber is low to medium. Robana soil in capability units IIIe–2 dryland and IVe–2 irrigated; Loamy range site. Turnerville soil in capability units IIIe–2 dryland and IVe–2 irrigated; not assigned to a range site.

Robana-Turnerville association, hilly (RTD).—The

Figure 8.—Summer cottage on Robana-Turnerville association, undulating.

moderately steep soils of this association are on uplands. The Robana soil is on slopes that face south and west, and the Turnerville soil is on slopes that face north and east. About 40 percent of this association is Robana silt loam, 10 to 20 percent slopes, and about 35 percent is Turnerville silt loam, 10 to 20 percent slopes. Included soils make up the remaining 25 percent. The profile of the Robana soil is similar to the one described as representative of the Robana series. The profile of the Turnerville soil is the one described as representative of the Turnerville series.

Included with these soils in mapping are areas of Decross loam, Cowdrey clay loam, and a Turnerville soil that has a surface layer of very fine sandy loam.

Runoff is medium, and the hazard of erosion is moderate.

This association is mainly used for dryland crops and as wildlife habitat. Some small areas are used for irrigated crops. Barley and alfalfa-bromegrass hay are the main crops. The Robana soil is also used for range, and forested areas of the Turnerville soil are used for grazed woodland. The suitability of the Turnerville soil for the production of fenceposts, poles, and sawtimber is low to medium. Robana soil in capability unit IVe–2 dryland; Loamy range site. Turnerville soil in capability unit IVe–2 dryland; not assigned to a range site.

Robana-Turnerville association, steep (RTE).—The steep soils of this association are on uplands. The Robana soil is on slopes that face south and west, and the Turnerville soil is on slopes that face north and east. About 40 percent of this association is Robana silt loam, 20 to 30 percent slopes, and about 40 percent is Turnerville silt loam, 20 to 30 percent slopes. The profiles of the Robana and Turnerville soils are similar to the ones described as representative of their respective series.

Included with these soils in mapping are areas of Decross loam, Rooset gravelly loam, and Cowdrey clay loam.

Runoff is rapid, and the hazard of erosion is high.

This association is mainly used for dryland crops and as wildlife habitat. Alfalfa-bromegrass hay is the main crop. The Robana soil is also used for range, and forested areas of the Turnerville soil are used for grazed woodland. The suitability of the Turnerville soil for the production of fenceposts, poles, and sawtimber is low to medium. Robana soil in capability unit VIe–1 dryland; Loamy range site. Turnerville soil in capability unit VIe–1 dryland; not assigned to a range site.

Rooset Series

The Rooset series consists of well-drained soils that formed in gravelly alluvium on foot slopes. The soils are moderately steep to very steep, and slopes are 10 to 60 percent. Elevation ranges from 5,700 to 7,500 feet. Vegetation is dominantly big sagebrush, serviceberry, rabbitbrush, basin wildrye, Kentucky bluegrass, and mountain brome. The average annual precipitation is 18 to 21 inches, the average annual temperature

is about 43° F, and the frost-free season is 30 to 50 days.

In a representative profile the surface layer is grayish-brown gravelly loam about 7 inches thick. The subsoil is brown gravelly and very gravelly clay loam about 23 inches thick. The substratum is light-brown very gravelly clay loam to a depth of 60 inches or more. The profile is neutral to a depth of 24 inches and moderately alkaline below that depth.

Permeability is moderately slow. Available water capacity, to a depth of 60 inches, is 4 to 6 inches. Effective rooting depth is 60 inches or more.

These soils are used for range and as wildlife habitat.

Representative profile of Rooset gravelly loam, 10 to 30 percent slopes, in an area of Greyback-Rooset association, hilly, in rangeland, about 2 miles south of Bedford in the SE¼SW¼SW¼ sec. 5, T. 33 N., R. 118 W., Lincoln County:

A1—0 to 7 inches, grayish-brown (10YR 5/2) gravelly loam, very dark grayish brown (10YR 3/2) moist; strong, fine, granular and crumb structure; soft, very friable, slightly sticky, slightly plastic; 15 percent gravel; neutral; clear, smooth boundary.

B1—7 to 11 inches, brown (10YR 5/3) gravelly clay loam, dark brown (10YR 3/3) moist; moderate, fine, subangular blocky structure; hard, very friable, slightly sticky and plastic; 15 percent gravel; a few, thin, glossy patches on faces of peds; neutral; clear, smooth boundary.

B2t—11 to 24 inches, brown (7.5YR 5/3) very gravelly clay loam, dark brown (7:5YR 4/3) moist; strong, fine, angular blocky structure; extremely hard, very friable, sticky and very plastic; 50 percent gravel; moderate, continuous, waxlike coatings on faces of peds; waxlike coatings on coarse fragments; waxlike coatings and fillings in root channels and pores; neutral; clear, wavy boundary.

B3ca—24 to 30 inches, brown (7.5YR 5/3) very gravelly clay loam, dark brown (7.5YR 4/3) moist; moderate, medium, subangular blocky structure; very hard, very friable, sticky and plastic; 75 percent gravel and cobbles; thin glossy patches on faces of peds; some glossy coatings in root channels; strong effervescense; secondary calcium carbonate as concretions in thin seams and streaks and as coatings on the gravel; moderately alkaline; gradual, wavy boundary.

Cca—30 to 60 inches, light-brown (7.5YR 6/4) very gravelly clay loam, brown (7.5YR 5/4) moist; massive; hard, very friable, sticky and plastic; few micro to fine roots; 75 percent gravel and cobbles; violent effervescence; secondary calcium carbonate occurring as concretions in thin seams and streaks and as coatings on the gravel; moderately alkaline.

Thickness of solum and depth to calcareous material range from 24 to 48 inches.

The A1 horizon has a hue of 10YR or 7.5YR, a value of 4 or 5 when dry and 2 or 3 when moist, and a chroma of 2 or 3 when dry or moist. It is generally gravelly loam but is silt loam or clay loam in places. Content of coarse fragments in the A1 horizon ranges from 15 to 50 percent.

The B2t horizon has a hue of 7.5YR or 10YR, a value of 5 or 6 when dry and 3 to 5 when moist, and chroma of 2 to 4 when dry or moist. It is generally very gravelly clay in places. Content of coarse fragments in the B2t horizon ranges from 35 to 60 percent. The B2t horizon is neutral or mildly alkaline.

The C horizon has a hue of 7.5YR or 10YR. It is very gravelly clay loam or very gravelly clay. Content of coarse fragments ranges from 35 to 60 percent.

Rooset soils are mapped only in associations with Greyback soils.

Splitro Series

The Splitro series consists of well-drained soils that formed in residuum from sandstone on upland ridges. The soils are sloping to steep, and slopes are 6 to 30 percent. Elevation ranges from 6,500 to 7,500 feet. Vegetation is mainly big sagebrush, Letterman needlegrass, and western wheatgrass. The average annual precipitation is 18 to 21 inches, the average annual temperature is about 43° F, and the frost-free season is 30 to 50 days.

In a representative profile the surface layer is dark grayish-brown fine sandy loam about 2 inches thick. The subsoil is dark-brown fine sandy loam about 9 inches thick. The substratum is light brownish-gray channery fine sandy loam about 4 inches thick. Hard sandstone is at a depth of about 15 inches. The profile is neutral.

Permeability is moderately rapid above the bedrock. Available water capacity is 1 to 3 inches. Effective rooting depth is 10 to 20 inches.

These soils are used for range and as wildlife habitat.

Representative profile of Splitro fine sandy loam, 6 to 30 percent slopes, in an area of Splitro complex, 6 to 30 percent slopes, in rangeland, about 3 miles northwest of Auburn, Wyoming, in SE¼SE¼NW¼ sec. 23, T. 7 S., R. 46 E., Caribou County:

A1—0 to 2 inches, dark grayish-brown (10YR 4/2) fine sandy loam, very dark grayish brown (10YR 3/2) moist; weak, fine and very fine, subangular blocky structure; soft, very friable, slightly sticky; 10 percent channers and flagstones; neutral; clear, wavy boundary.

B2—2 to 11 inches, dark-brown (10YR 4/3) fine sandy loam, dark brown (10YR 3/3) moist; weak, coarse, prismatic structure parting to moderate, medium and fine, subangular blocky; slightly hard, very friable, slightly sticky; common micro to fine roots; 10 percent channers and flagstones; neutral; clear, wavy boundary.

C—11 to 15 inches, light brownish-gray (10YR 6/2) channery fine sandy loam, dark grayish brown (10YR 4/2) moist; massive; soft, very friable, slightly sticky; common micro to fine roots; 30 percent channers and flagstones; neutral; gradual, wavy boundary.

R—15 inches, gray, hard sandstone.

Depth to bedrock ranges from 10 to 20 inches. Content of coarse fragments ranges from 0 to 35 percent. Reaction is neutral or slightly acid.

Splitro complex, 6 to 30 percent slopes (SPE).—The sloping to steep soils of this complex are on ridgetops. About 40 percent of this complex is Splitro fine sandy loam, 6 to 30 percent slopes, and about 40 percent is soils that are similar to this Splitro soil but are very flaggy fine sandy loam. The profile of the Splitro soil is the one described as representative of the Splitro series. Use and management are essentially the same for the two soils.

Included with these soils in mapping are areas of rock outcrop and moderately deep fine sandy loams.

Runoff is slow to rapid, and the hazard of erosion is slight to high.

This complex is used for range and as wildlife habitat. Capability unit VIIe–1 dryland; Shallow Loamy range site.

Starley Series

The Starley series consists of well-drained soils that formed in residuum on upland ridges. The soils are sloping to very steep, and slopes are 6 to 60 percent. Elevation ranges from 6,500 to 7,500 feet. Vegetation is mainly big sagebrush, serviceberry, snowberry, Kentucky bluegrass, and mountain bromegrass. The average annual precipitation is 18 to 21 inches, the average annual temperature is about 43° F, and the frost-free season is 30 to 50 days.

In a representative profile the surface layer is brown cobbly silty clay loam about 7 inches thick. The substratum is very pale brown very cobbly silty clay loam about 7 inches thick. Hard limestone bedrock is at a depth of 14 inches. The profile is mildly alkaline to moderately alkaline.

Permeability is moderate above the bedrock. Available water capacity is 1 to 3 inches. Effective rooting depth is 10 to 20 inches.

These soils are used for range and as wildlife habitat.

Representative profile of Starley cobbly silty clay loam, 6 to 30 percent slopes, in rangeland, about 3 miles south of Fairview in SE¼SE¼ sec. 28, T. 31 N., R. 119 W., Lincoln County:

A1—0 to 7 inches, brown (10YR 5/3) cobbly silty clay loam, dark brown (10YR 3/3) moist; weak, medium, subangular blocky structure parting to moderate, fine, granular; slightly hard, friable, sticky and plastic; 40 percent limestone fragments; matrix weak effervescence; mildly alkaline; clear, wavy boundary.

C—7 to 14 inches, very pale brown (10YR 7/3) very cobbly silty clay loam, brown (10YR 5/3) moist; massive; slightly hard, friable, sticky and plastic; 75 percent limestone fragments; strong effervescence; inconsistent secondary calcium carbonate as coatings on the underside of a few coarse fragments, moderately alkaline; gradual, wavy boundary.

R—14 inches, hard limestone bedrock.

Depth to limestone bedrock ranges from 10 to 20 inches. The A1 horizon has a value of 4 or 5 when dry and 2 or 3 when moist and a chroma of 2 or 3 when dry and moist. It is cobbly silty clay loam to cobbly loam. The content of coarse fragments in the A1 horizon ranges from 35 to 50 percent.

The C horizon has a value of 6 or 7 when dry and 4 or 5 when moist. It ranges from very cobbly loam to very cobbly silty clay loam. The content of coarse fragments in the C horizon ranges from 35 to 70 percent.

Starley cobbly silty clay loam, 6 to 30 percent slopes (SSE).—This sloping to steep soil is on upland ridges. The profile of this soil is the one described as representative of the series.

Included with this soil in mapping are areas of Buckskin silt loam and areas of Rock outcrop, each of which makes up about 10 percent of the mapped areas.

Runoff is medium to rapid, and the hazard of erosion is moderate to high.

This soil is used for range and as wildlife habitat. Capability unit VIIe–1 dryland; Shallow Loamy range site.

Starley complex, 6 to 30 percent slopes (STE).—The sloping to steep soils of this complex are on ridgetops. About 40 percent of this complex is Starley cobbly silty clay loam, 6 to 30 percent slopes, and about 30 percent is soils that are similar to this Starley soil but are deep silty clay loams. Included soils make up the remaining 30 percent. The profile of the Starley soil is similar to the one described as representative of the Starley series. Use and management of the two soils are similar.

Included with these soils in mapping are areas of rock outcrop, dark-colored clays, and light-colored silty clay loams.

Runoff is medium to rapid, and the hazard of erosion is moderate to high.

This complex is used for range and as wildlife habitat. Capability unit VIIe–1 dryland; Shallow Loamy range site.

Stony rock land

Stony rock land (SY) consists of about 50 percent rock outcrop and about 50 percent very stony and gravelly, shallow and very shallow colluvium. Areas are very steep, and slopes face south and west.

Runoff is rapid, and the hazard of erosion is high in the colluvium.

This land type is used mainly as wildlife habitat. Capability unit VIIe–1 dryland; Very Shallow range site.

Thayne Series

The Thayne series consists of well-drained soils that formed in alluvium on alluvial fans. The soils are nearly level to gently sloping, and slopes are 0 to 6 percent. Elevation ranges from 5,700 to 6,500 feet. Vegetation is mainly big sagebrush, serviceberry, Kentucky bluegrass, and basin wildrye. The average annual precipitation is 18 to 21 inches, the average annual temperature is about 43° F, and the frost-free season is 30 to 50 days.

In a representative profile the surface layer is dark grayish-brown loam about 12 inches thick. The subsoil is light olive-brown gravelly loam about 12 inches thick. The substratum is pale-yellow very gravelly loam to a depth of 60 inches or more. The profile is neutral to mildly alkaline to a depth of 24 inches and is moderately alkaline below that depth.

Permeability is moderate. Available water capacity, to a depth of 60 inches, is 3 to 9 inches. Effective rooting depth is 60 inches or more.

These soils are used for irrigated and dryland crops and as wildlife habitat.

Representative profile of Thayne loam, 0 to 3 percent slopes, in rangeland, about 300 feet south of the abandoned house in NW¼SW¼ sec. 35, T. 36 N., R. 119 W., Lincoln County:

A1—0 to 12 inches, dark grayish-brown (10YR 4/2) loam, very dark brown (10YR 2/2) moist; strong, fine, granular structure; soft, very friable, nonsticky and nonplastic; 5 percent limestone gravel and channers; neutral; gradual, smooth boundary.

B2—12 to 24 inches, light olive-brown (2.5Y 5/3) gravelly loam, olive brown (2.5Y 4/3) moist; moderate, fine, subangular blocky structure; slightly hard, very friable, slightly sticky and slightly plastic; few glossy patches on faces of peds; 15 percent limestone gravel and flat fragments; slight effervescence; mildly alkaline; diffuse, wavy boundary.

Cca—24 to 60 inches, pale-yellow (2.5Y 7/3) very gravelly loam, light yellowish brown (2.5Y 6/3) moist; massive; slightly hard, very friable, slightly sticky and slightly plastic; 50 percent limestone gravel and cobbles; strong effervescence; secondary calcium

carbonate as coatings on gravel and cobble fragments and in thin seams and streaks; moderately alkaline.

Depth to calcareous material ranges from 0 to 15 inches. The solum ranges from 15 to 40 inches in thickness.

The A1 horizon has a hue of 10YR or 2.5Y, a value of 4 or 5 when dry and 2 or 3 when moist, and a chroma of 2 or 3 when dry or moist. It is loam or silt loam. Content of coarse fragments in the A1 horizon ranges from 0 to 35 percent. The A1 horizon is neutral or mildly alkaline.

The B horizon has a hue of 2.5Y or 10YR, a value of 5 or 6 when dry and 4 or 5 when moist, and a chroma of 2 or 3 when dry or moist. It is gravelly loam or gravelly silt loam. Content of coarse fragments in the B horizon ranges from 15 to 35 percent. The B horizon is mildly alkaline or moderately alkaline.

The C horizon has a hue of 2.5Y or 10YR. Content of coarse fragments in the C horizon ranges from 35 to 80 percent.

Thayne loam, 0 to 3 percent slopes (TeA).—This nearly level soil is on alluvial fans. The profile of this soil is the one described as representative of the series.

Included with this soil in mapping are areas of Thayne gravelly loam, which make up about 10 percent of the mapped areas, and areas of Huffine silt loam, which make up about 5 percent.

Runoff is slow, and the hazard of erosion is slight. Available water capacity, to a depth of 60 inches, is 4 to 9 inches.

This soil is used for irrigated and dryland crops, for range, and as wildlife habitat. Barley and alfalfa-bromegrass hay are the main crops. Capability units IIIs–2 dryland and IIIs–2 irrigated; Loamy range site.

Thayne loam, 3 to 6 percent slopes (TeB).—This gently sloping soil is on alluvial fans. The profile of this soil is similar to the one described as representative of the series.

Included with this soil in mapping are areas of Thayne gravelly loam, which make up about 10 percent of the mapped areas, and areas of Huffine silt loam, which make up about 5 percent.

Runoff is slow, and the hazard of erosion is slight. Available water capacity, to a depth of 60 inches, is 4 to 9 inches.

This soil is used for irrigated and dryland crops, for range, and as wildlife habitat. Capability units IIIe–2 dryland and IIIe–2 irrigated; Loamy range site.

Thayne gravelly loam, 0 to 3 percent slopes (ThA).—This nearly level soil is on alluvial fans. The profile of this soil is similar to the one described as representative of the series, but the surface layer is gravelly loam.

Included with this soil in mapping are areas of Greyback gravelly loam, which make up about 15 percent of the mapped areas, and areas of Thayne loam, which make up about 5 percent.

Runoff is slow, and the hazard of erosion is slight. Available water capacity, to a depth of 60 inches, is 3 to 8 inches.

This soil is used for irrigated and dryland crops, for range, and as wildlife habitat. Barley and alfalfa-bromegrass hay are the main crops. Capability units IIIs–2 dryland and IIIs–2 irrigated; Loamy range site.

Thayne gravelly loam, 3 to 6 percent slopes (ThB).—This gently sloping soil is on alluvial fans. The profile of this soil is similar to the one described as representative of the series, but the surface layer is gravelly loam.

Included with this soil in mapping are areas of Greyback gravelly loam, which makes up 15 percent of the mapped areas; areas of Thayne loams, which make up about 5 percent; and about 60 acres of Thayne gravelly loam that has slopes of 6 to 10 percent.

Runoff is slow, and the hazard of erosion is slight. Available water capacity, to a depth of 60 inches, is 3 to 8 inches.

This soil is used for irrigated and dryland crops, for range, and as wildlife habitat. Barley and alfalfa-bromegrass hay are the main crops. Capability units IIIe–2 dryland and IIIe–2 irrigated; Loamy range site.

Turnerville Series

The Turnerville series consists of well-drained soils that formed in wind-deposited silt on uplands. The soils are gently sloping to steep, and slopes are 3 to 30 percent. Elevation ranges from 5,600 to 7,500 feet. Vegetation is mainly quaking aspen, lodgepole pine, pine grass, snowberry, and vetch clover. The average annual precipitation is 18 to 21 inches, the average annual temperature is about 40° F, and the frost-free season is 30 to 50 days.

In a representative profile about 3 inches of undecomposed and partly decomposed needles, barks, and twigs overlie a surface layer of grayish-brown silt loam about 3 inches thick. The subsurface layer is light-gray silt loam about 12 inches thick. The next layer consists of light-gray and brown silt loam about 15 inches thick. Nodules and seams of material similar to the subsoil are embedded in this layer. The subsoil is brown silty clay loam and silt loam about 30 inches thick. The substratum is pale-brown silt loam to a depth of 70 inches or more. The profile is slightly acid to neutral.

Permeability is moderate. Available water capacity, to a depth of 60 inches, is 11 to 13 inches. Effective rooting depth is 60 inches or more.

These soils are mainly used for grazed woodland, as wildlife habitat, and as homesites. Some areas have been cleared and are used for dryland crops.

Representative profile of Turnerville silt loam, 10 to 20 percent slopes, in Robana-Turnerville association, hilly, in woodland, about 2 miles south and 1½ miles east of Etna in NW¼SW¼ sec. 24, T. 35 N., R. 119 W., Lincoln County:

O1—3 to 2 inches, undecomposed needles, bark, twigs, and the remains of plants.

O2—2 inches to 0, partly decomposed organic material similar to O1 horizon.

A1—0 to 3 inches, grayish-brown (10YR 5/2) silt loam, dark grayish brown (10YR 4/2) moist; moderate, fine, crumb structure; soft, very friable, nonsticky and nonplastic; slightly acid; gradual, smooth boundary.

A2—3 to 15 inches, light-gray (10YR 7/2) silt loam, pale brown (10YR 6/3) moist; weak, thick, platy structure parting to very fine, subangular blocky and granular; soft, very friable, nonsticky and nonplastic; vesicular; slightly acid; gradual, wavy boundary.

A&B—15 to 30 inches, mixed light-gray (10YR 7/2) and brown (10YR 5/3) silt loam, light brownish gray (10YR 6/2) and dark brown (10YR 4/3) moist; weak, medium and fine, subangular blocky structure; slightly hard, friable, slightly sticky and slightly plastic; thin glossy patches on faces of most clayey peds; nodules and seams of clayey

material similar to the B2t horizon embedded in a light-colored matrix similar to the A2 horizon; neutral; gradual, wavy boundary.

B2t—30 to 50 inches, brown (10YR 5/3) silty clay loam, dark brown (10YR 4/3) moist; moderate, medium and fine, subangular blocky structure; hard, very friable, sticky and plastic; thin, continuous, waxlike coatings on faces of peds; waxlike fillings in pores; surface coatings of bleached sand and silt; neutral; gradual, smooth boundary.

B3—50 to 60 inches, brown (10YR 5/3) silt loam, dark brown (10YR 4/3) moist; weak, medium, subangular blocky structure; hard, friable, slightly sticky and slightly plastic; few thin glossy patches on faces of peds; neutral; gradual, wavy boundary.

C—60 to 70 inches, pale-brown (10YR 6/3) silt loam, brown (10YR 5/3) moist; massive; slightly hard, friable, slightly sticky and slightly plastic; neutral.

The solum ranges from 30 to 60 inches or more in thickness. These soils are generally noncalcareous to a depth of more than 60 inches, but their reaction is inconsistent and they are mildly calcareous below a depth of 40 inches in places. Content of coarse fragments ranges from 0 to 10 percent.

The A1 horizon is discontinuous in places. The A2 horizon ranges in hue from 2.5Y to 7.5Y, value is 5 to 7 when dry and 4 to 6 when moist, and chroma is 2 to 4 when dry or moist. It is generally platy but is granular or subangular blocky in places. It is medium acid to mildly alkaline.

The B2t horizon has a hue of 10YR or 7.5YR, a value of 5 or 6 when dry and 4 or 5 when moist, and a chroma of 3 or 4 when dry or moist. It is generally subangular blocky but is prismatic in places. It is neutral to mildly alkaline.

Turnerville soils are only mapped in associations with Robana soils.

Turson Series

The Turson series consists of somewhat poorly drained soils that formed in alluvium on flood plains and low terraces. The soils are nearly level, and slopes are 0 to 3 percent. Elevation ranges from 5,600 to 7,000 feet. Vegetation is mainly willows, Kentucky bluegrass, western wheatgrass, and sedges. The average annual precipitation is 18 to 21 inches, the average annual temperature is about 41° F, and the frost-free season is 30 to 50 days.

In a representative profile the surface layer is brown silt loam about 12 inches thick. The upper part of the substratum is pinkish-gray silt loam about 18 inches thick. The lower part of the substratum is pinkish-gray very gravelly loamy sand to a depth of 60 inches or more. The profile is moderately alkaline.

Permeability is moderate to a depth of about 30 inches and is rapid below that depth. Available water capacity, to a depth of 60 inches, is 4 to 10 inches. Effective rooting depth is 60 inches or more. The water table fluctuates between depths of 30 and 60 inches. These soils are generally flooded annually for short periods during spring and early in summer (fig. 10) because of limited channel capacity. During these periods flood water flows slowly onto these soils and results in little or no damage.

These soils are used for native pasture, for irrigated crops, and as wildlife habitat.

Representative profile of Turson silt loam, in a meadow, about 210 feet southeast of the west quarter corner of sec. 14, T. 32 N., R. 119 W., Lincoln County:

A1—0 to 12 inches, brown (7.5YR 5/2) silt loam, dark brown (7.5YR 3/2) moist; weak, fine, subangular blocky structure parting to moderate, fine, granu-

Figure 9.—Spring flooding on Turson silt loam.

lar; slightly hard, friable, slightly sticky and slightly plastic; strong effervescence; moderately alkaline; clear, wavy boundary.

C—12 to 30 inches, pinkish-gray (7.5YR 6/2) silt loam, dark brown (7.5YR 4/2) moist; common, fine, distinct, light yellowish-brown (10YR 6/4) mottles dry; massive; slightly hard, friable, slightly sticky and slightly plastic; violent effervescence; moderately alkaline; clear, wavy boundary.

IIC—30 to 60 inches, pinkish-gray (7.5YR 6/2) very gravelly loamy sand, dark brown (7.5YR 4/2) moist; single grained; loose when dry and moist; slight effervescence; moderately alkaline.

Depth to very gravelly material ranges from 20 to 40 inches. These soils are generally calcareous throughout, but a few inches of the surface layer are noncalcareous in places.

The A1 horizon has a hue of 7.5YR or 10YR, a value of 4 or 5 when dry and 2 or 3 when moist, and a chroma of 1 to 3 when dry or moist. It is generally silt loam but ranges from loam to silty clay loam. It is mildly alkaline or moderately alkaline.

The C horizon has a hue of 7.5YR or 2.5Y, a value of 5 or 6 when dry and 4 or 5 when moist, and a chroma of 2 to 4 when dry or moist. Mottles are few or common, fine or medium, and faint or distinct. The C horizon is generally silt loam but ranges from loam to silty clay loam. Content of coarse fragments in the C horizon ranges from 0 to 35 percent. The C horizon is mildly alkaline or moderately alkaline. Content of coarse fragments in the IIC horizon ranges from 50 to 80 percent. The texture of the fine earth fraction is loamy sand or sand.

Turson silt loam (Tu).—This soil is on flood plains and low terraces. Slopes are 0 to 3 percent. The profile of this soil is the one described as representative of the series.

Included with this soil in mapping are areas of Dipman clay loam, which makes up about 5 percent of the mapped areas; areas of silt loams that are very gravelly below a depth of 40 inches, which make up about 10 percent; and areas of somewhat poorly drained silt loams, which make up about 10 percent.

Runoff is slow, and the hazard of erosion is slight.

This soil is used for native pasture, for irrigated crops, and as wildlife habitat. Barley and alfalfa-bromegrass hay are the main crops. This soil is suited to dryland crops. Capability units IIIw–62 dryland and IIIw–62 irrigated; Subirrigated range site.

Valleono Series

The Valleono series consists of well-drained soils that formed in alluvium on alluvial fans and terraces. The soils are nearly level, and slopes are 0 to 3 percent. Elevation ranges from 5,700 to 7,000 feet. Vegetation is mainly big sagebrush, Kentucky bluegrass, bluebunch wheatgrass, and basin wildrye. The average annual precipitation is 18 to 21 inches, the average annual temperature is about 43° F, and the frost-free season is 30 to 50 days.

In a representative profile the surface layer is brown silty clay loam about 6 inches thick. The upper part of the subsoil is reddish-brown silty clay loam to silty clay about 14 inches thick. The lower part of the subsoil is reddish-brown clay loam about 4 inches thick. The substratum is reddish-brown gravelly loam to light reddish-brown very gravelly loamy sand to a depth of 60 inches or more. The profile is moderately alkaline below a depth of 20 inches.

Permeability is moderately slow. Available water capacity, to a depth of 60 inches, is 5 to 9 inches. Effective rooting depth is 60 inches or more.

These soils are used for irrigated crops, for range, and as wildlife habitat.

Representative profile of Valleono silty clay loam, in a cultivated field, about ½ mile northwest of Auburn, Wyoming, and about 240 feet north of the gate in the road fence in SE¼NW¼SW¼ sec. 35, T. 33 N., R. 119 W., Lincoln County:

Ap—0 to 6 inches, brown (7.5YR 5/2) silty clay loam, dark brown (7.5YR 3/2) moist; weak, medium, subangular blocky structure parting to moderate, fine, granular; slightly hard, very friable, slightly sticky and plastic; neutral; abrupt, smooth boundary.

B1t—6 to 9 inches, reddish-brown (5YR 5/3) silty clay loam, dark reddish brown (5YR 3/3) moist; weak, medium, prismatic structure parting to moderate, fine, angular and subangular blocky; hard, very friable, sticky and plastic; few, thin, glossy patches on faces of peds; weak glossy coatings in root channels; neutral; clear, smooth boundary.

B2t—9 to 20 inches, reddish-brown (5YR 5/3) silty clay, reddish brown (5YR 4/3) moist; moderate, medium, prismatic structure parting to strong, fine, angular blocky; very hard, friable, very sticky and very plastic; thin, nearly continuous, waxlike coatings on faces of peds and in root channels; mildly alkaline; gradual, wavy boundary.

B3tca—20 to 24 inches, reddish-brown (5YR 5/3) clay loam, reddish brown (5YR 4/3) moist; weak, medium, prismatic structure parting to weak, medium, subangular blocky; very hard, friable, sticky and plastic; common, thin, waxlike patches on faces of peds; weak waxlike coatings in root channels; violent effervescence; secondary calcium carbonate as concretions and in thin seams and streaks; moderately alkaline; clear, wavy boundary.

Cca—24 to 30 inches, reddish-brown (5YR 5/3) gravelly loam, reddish brown (5YR 4/3) moist; massive; hard, very friable, slightly sticky and slightly plastic; violent effervescence; secondary calcium carbonate as concretions; moderately alkaline; clear, wavy boundary.

IIC—30 to 60 inches, light reddish-brown (5YR 6/3) very gravelly loamy sand, reddish brown (5YR 4/3) moist; massive; slightly hard, very friable, nonsticky and nonplastic; 60 percent gravel; violent effervescence; moderately alkaline.

Depth to calcareous material ranges from 10 to 30 inches. The solum ranges from 15 to 30 inches in thickness. Depth to the very gravelly substratum ranges from 20 to 40 inches.

The Ap horizon has a hue of 7.5YR or 10YR, a value of 4 or 5 when dry and 2 or 3 when moist, and a chroma of 2 or 3 when dry or moist. It is silty clay loam or silt loam and is granular, crumb, or subangular blocky.

The B2t horizon has a hue of 5YR or 7.5YR, a value of 5 to 6 when dry, and a chroma of 3 or 4 when dry or moist. It is generally silty clay but is clay loam or silty clay loam in places. Content of coarse fragments in the B2t horizon ranges from 0 to 15 percent. The B2t horizon is neutral or mildly alkaline.

The IIC horizon has a hue of 5YR or 7.5YR. Content of coarse fragments in the IIC horizon ranges from 50 to 80 percent.

Valleono silty clay loam (Va).—This nearly level soil is on alluvial fans and terraces. The profile of this soil is the one described as representative of the series.

Included with this soil in mapping are areas of Paulson silty clay loam, which makes up about 15 percent of the mapped areas; areas of Leavittville silt loams, which make up about 5 percent; and areas of Osmund loam, which makes up about 5 percent.

Runoff is slow, and the hazard of erosion is slight.

This soil is used for irrigated crops, for range, and

as wildlife habitat. Barley and alfalfa-bromegrass hay are the main crops. The soil is suited to dryland crops. Capability units IIIs–1 dryland and IIIs–1 irrigated; Loamy range site.

Willow Creek Series

The Willow Creek series consists of well-drained soils that formed in wind-deposited silt on uplands. The soils are gently sloping to moderately steep, and slopes are 3 to 20 percent. Elevation ranges from 6,000 to 7,500 feet. Vegetation is mainly big sagebrush, serviceberry, Kentucky bluegrass, bluebunch wheatgrass, and basin wildrye. The average annual precipitation is 18 to 21 inches, the average annual temperature is about 44° F, and the frost-free season is 30 to 50 days.

In a representative profile the surface layer is dark grayish-brown silt loam about 10 inches thick. The subsoil is brown and pale-brown silty clay loam about 27 inches thick. The substratum is very pale brown silt loam to a depth of 60 inches or more. The profile is neutral to a depth of 31 inches and is moderately alkaline below that depth.

Permeability is moderate. Available water capacity, to a depth of 60 inches, is 11 to 13 inches. Effective rooting depth is 60 inches or more.

These soils are used for irrigated and dryland crops, for range, as wildlife habitat, and as homesites.

Representative profile of Willow Creek silt loam, 3 to 10 percent slopes, in an area of Willow Creek-Bozeman association, undulating, in a cultivated field, about 1 mile south of Fairview and about 330 feet south and 130 feet east of northwest corner of NE¼ NW¼ sec. 15, T. 31 N., R. 119 W., Lincoln County:

Ap—0 to 10 inches, dark grayish-brown (10YR 4/2) silt loam, very dark grayish brown (10YR 3/2) moist; weak, fine, subangular blocky structure; slightly hard, friable, slightly sticky and slightly plastic; neutral; abrupt, smooth boundary.

B21t—10 to 18 inches, brown (10YR 5/3) silty clay loam, dark brown (10YR 4/3) moist; moderate, medium, prismatic structure parting to moderate, fine, subangular blocky; hard, friable, sticky and plastic; neutral; gradual, wavy boundary.

B22t—18 to 31 inches, brown (7.5YR 5/4) silty clay loam, dark brown (7.5YR 4/4) moist; moderate, medium, prismatic structure parting to moderate, fine, subangular blocky; hard, friable, sticky and plastic; thin, nearly continuous, waxlike coatings on faces of peds; neutral; clear, wavy boundary.

B3ca—31 to 37 inches, pale-brown (10YR 6/3) silty clay loam, brown (10YR 5/3) moist; weak, medium, prismatic structure parting to weak, fine, subangular blocky; slightly hard, friable, sticky and plastic; strong effervescence; secondary calcium carbonate in streaks; moderately alkaline.

Cca—37 to 60 inches, very pale brown (10YR 7/3) silt loam, pale brown (10YR 6/3) moist; massive; slightly hard, friable, slightly sticky and slightly plastic; violent effervescence; secondary calcium carbonate as concretions and streaks; moderately alkaline.

The solum ranges from 20 to 50 inches in thickness. Depth to calcareous material ranges from 15 to 40 inches.

The A horizon has a hue of 7.5YR or 10YR, a value of 4 or 5 when dry and 2 or 3 when moist, and a chroma of 2 or 3 when dry or moist. It is granular, crumb, or subangular blocky and is neutral or mildly alkaline.

The B2t horizon has a hue of 7.5YR or 10YR, a value of 5 or 6 when dry and 4 to 5 when moist, and a chroma of 2 to 4 when dry or moist. It is silty clay loam or silt loam. It is neutral or mildly alkaline.

The C horizon has a hue of 7.5YR or 10YR, a value of 6 to 8 when dry and 5 or 6 when moist, and a chroma of 2 to 4 when dry or moist. It is silt loam or silty clay loam.

Willow Creek-Bozeman association, undulating (WcC).—The gently sloping to sloping soils of this association are on uplands. The Willow Creek soil is on upper side slopes and knolls that face south, the Bozeman soil is on lower slopes that face south, and the Robana soil is on side slopes that face north. About 40 percent of this association is Willow Creek silt loam, 3 to 10 percent slopes; about 25 percent is Bozeman silt loam, 3 to 10 percent slopes, and about 25 percent is Robana silt loam, 3 to 10 percent slopes. Included soils make up the remaining 10 percent. The profiles of the Willow Creek and Bozeman soils are the ones described as representative of their respective series. The profile of the Robana soil is similar to the one described as representative of the Robana series.

Included with these soils in mapping are areas of Huffine silt loam and Bozeman silt loam, 0 to 3 percent slopes.

Runoff is slow to medium, and the hazard of erosion is slight to moderate.

This association is used for irrigated and dryland crops, for range, as wildlife habitat, and as homesites. Barley and alfalfa-bromegrass hay are the main crops. Capability units IIIe–2 dryland and IVe–2 irrigated; Loamy range site.

Willow Creek-Bozeman association, hilly (WcD).—The moderately steep soils of this association are on uplands. The Willow Creek soil is on upper side slopes and ridgetops that face south, the Bozeman soil is on lower side slopes that face south, and the Robana soil is on slopes that face north. About 40 percent of this association is Willow Creek silt loam, 10 to 20 percent slopes, about 25 percent is Bozeman silt loam, 10 to 20 percent slopes, and about 25 percent is Robana silt loam, 10 to 20 percent slopes. Included soils make up the remaining 10 percent. The profiles of these soils are similar to the ones described as representative of their respective series.

Included with these soils in mapping are areas of very deep soils that are silt loam throughout.

Runoff is medium, and the hazard of erosion is moderate.

This association is mainly used for dryland crops, for range, and as wildlife habitat. Some small areas are used for irrigated crops. Barley and alfalfa-bromegrass hay are the main crops. Capability unit IVe–2 dryland; Loamy range site.

Use and Management of the Soils

This section describes the use and management of the soils of the Star Valley Area for crops, for range, as wildlife habitat, and for engineering and recreation uses.

Crops[3]

This section describes the capability classification system used by the Soil Conservation Service and its

[3] ROBERT L. TRESLER, agronomist, Soil Conservation Service, assisted with this section.

application in this survey area. It also describes management of dryland capability units and irrigated capability units. In addition, this section contains a brief description of predicted yields and a table of yields of the major crops that can be expected under a high level of management.

Because both dryland and irrigated farming are practiced in Star Valley Area, each capability unit is designated as either dryland or irrigated. Some soils are in both dryland and irrigated capability units. Robana silt loam, 0 to 3 percent slopes, for example, is in capability unit IIIc–2 dryland and IIIc–2 irrigated. The capability classification of each soil mapped in the area can be learned by referring to the "Guide to Mapping Units."

Capability grouping

Capability grouping shows, in a general way, the suitability of soils for most kinds of field crops. The soils are grouped according to their limitations when used for field crops, the risk of damage when they are so used, and the way they respond to treatment. The grouping does not take into account major and generally expensive landforming that would change slope, depth, or other characteristics of the soils; does not take into consideration possible but unlikely major reclamation projects; and does not apply to rice, cranberries, horticultural crops, or other crops requiring special management.

Those familiar with the capability classification can infer from it much about the behavior of soils when used for other purposes, but this classification is not a substitute for interpretations designed to show suitability and limitations of groups of soils for range, forest trees, or engineering.

In the capability system, the kinds of soils are grouped at three levels: the capability class, subclass, and unit. These are discussed in the following paragraphs.

CAPABILITY CLASSES, the broadest groups, are designated by Roman numerals I through VIII. The numerals indicate progressively greater limitations and narrower choices for practical use, defined as follows:

Class I soils have few limitations that restrict their use. (None in this survey area.)

Class II soils have moderate limitations that reduce the choice of plants or that require moderate conservation practices. (None in this survey area.)

Class III soils have severe limitations that reduce the choice of plants, require special conservation practices, or both.

Class IV soils have very severe limitations that reduce the choice of plants, require very careful management, or both.

Class V soils are not likely to erode but have other limitations, impractical to remove, that limit their use largely to pasture, range, woodland, or wildlife.

Class VI soils have severe limitations that make them generally unsuited to cultivation and limit their use largely to pasture or range, woodland, or wildlife.

Class VII soils have very severe limitations that make them unsuited to cultivation and that restrict their use largely to pasture or range, woodland, or wildlife.

Class VIII soils and landforms have limitations that preclude their use for commercial plants and restrict their use to recreation, wildlife, water supply, or esthetic purposes. (None in this survey area.)

CAPABILITY SUBCLASSES are soil groups within one class; they are designated by adding a small letter, *e*, *w*, *s*, or *c*, to the class numeral, for example, IIIe. The letter *e* shows that the main limitation is risk of erosion unless close-growing plant cover is maintained; *w* shows that water in or on the soil interferes with plant growth or cultivation (in some soils the wetness can be partly corrected by artificial drainage); *s* shows that the soil is limited mainly because it is shallow, droughty, or stony; and *c*, used in only some parts of the United States, shows that the chief limitation is climate that is too cold or too dry.

In class I there are no subclasses, because the soils of this class have few limitations. Class V can contain, at the most, only the subclasses indicated by *w*, *s*, and *c*, because the soils in class V are subject to little or no erosion, though they have other limitations that restrict their use largely to pasture, range, woodland, wildlife, or recreation.

CAPABILITY UNITS are soil groups within the subclasses. The soils in one capability unit are enough alike to be suited to the same crops and pasture plants, to require similar management, and to have similar productivity and other responses to management. Thus, the capability unit is a convenient grouping for making many statements about management of soils. Capability units are generally designated by adding an Arabic numeral to the subclass symbol, for example, IIIs–2 or IVe–1. Thus, in one symbol, the Roman numeral designates the capability class, or degree of limitation; the small letter indicates the subclass, or kind of limitation as defined in the foregoing paragraph; and the Arabic numeral specifically identifies the capability unit within each subclass. In Wyoming the capability units are assigned according to a statewide system. Not all the units in this system are used in Star Valley Area, and for this reason the numbering of the capability units is not consecutive in all cases.

Management of the soils for dryland farming

Dryland farming has been an important part of the agriculture in the survey area ever since the homesteaders arrived in 1879. Barley and alfalfa-bromegrass hay are the principal dryland crops.

The main concerns generally associated with dryland farming, such as lack of moisture and erosion, are not serious in Star Valley Area. The average annual precipitation is 18 to 21 inches. Some summer fallowing is practiced, mainly for weed control rather than for moisture conservation. As the winter accumulation of snow melts in spring, most of the water enters the soil. In many cases this supplies enough water to fill the soil to near field capacity by planting time. Most of the summer rains are gentle and soak into the soil without causing any erosion.

Maintenance of fertility is not generally a concern. The short growing season in the Area limits crop production more than any other factor. The frost-free season is 30 to 50 days.

Compaction from tillage is a concern on some soils. This can be avoided by varying the depth of plowing and avoiding tillage when the soils are too wet.

Returning crop residue to the soil helps to maintain organic-matter content and structure and increases the intake of water. This helps to maintain tilth and to control erosion. The use of grassed waterways on the steeper slopes and in draws helps to control erosion.

The soils in dryland capability units are described on the following pages, and suggestions for use and management are given. Soils in Class VII have been grouped into a single unit because their management is similar.

CAPABILITY UNIT IIIc–1 DRYLAND

Paulson silty clay loam, 0 to 3 percent slopes, the only soil in this unit, is well drained. The surface layer is silty clay loam, and the subsoil is silty clay loam to silty clay. Slopes are 0 to 3 percent.

Permeability is moderately slow. Runoff is slow, and the hazard of erosion is slight. Available water capacity is 7 to 11 inches. Effective rooting depth is 60 inches or more.

This soil is suited to dryland crops, such as barley and alfalfa-bromegrass hay. It is also suited to range and wildlife habitat.

This soil has a narrow range of moisture content that is optimum for cultivation. If the soil is tilled when it is too wet, its structure is destroyed. If it is tilled when too dry, hard clods are formed. If this soil is cultivated, returning crop residue to the soil helps to maintain structure and tilth and increases the intake of water.

CAPABILITY UNIT IIIc–2 DRYLAND

Robana silt loam, 0 to 3 percent slopes, the only soil in this unit, is well drained. The surface layer is silt loam, and the subsoil is silt loam and silty clay loam. Slopes are 0 to 3 percent.

Permeability is moderate. Runoff is slow, and the hazard of erosion is slight. Available water capacity is 11 to 13 inches. Effective rooting depth is 60 inches or more.

This soil is used for dryland crops. Barley and alfalfa-bromegrass hay are the main crops. It is well suited to recreation and wildlife habitat.

If this soil is cultivated, crop rotation and returning crop residue to the soil are good management practices.

CAPABILITY UNIT IIIe–1 DRYLAND

This unit consists of well-drained soils that have a surface layer of silt loam or silty clay loam. The subsoil is silty clay loam to silty clay. Slopes are 3 to 10 percent.

Permeability is moderately slow. Runoff is slow to rapid, and the hazard of erosion is slight to severe. Available water capacity is 7 to 12 inches. Effective rooting depth is 60 inches or more.

These soils are used for dryland crops, for range, and as wildlife habitat. Barley and alfalfa-bromegrass hay are the main crops.

Some of the soils have a narrow range of moisture content that is optimum for cultivation. If these soils are tilled when too wet, the structure is destroyed. If the soils are tilled when too dry, hard clods are formed. A good seedbed is difficult to prepare under either of these conditions.

If the soils are cultivated, returning crop residue to the soil helps to maintain structure and tilth and increases the intake of water. Grassed waterways help to control erosion.

CAPABILITY UNIT IIIe–2 DRYLAND

This unit consists of well-drained soils that have a surface layer of gravelly loam, loam, or silt loam. The subsoil is gravelly loam, silt loam, or silty clay loam. Slopes are 3 to 10 percent.

Permeability is moderate. Runoff is slow to medium, and the hazard of erosion is slight to moderate. Available water capacity is 3 to 13 inches. Effective rooting depth is 60 inches or more.

These soils are mainly used for dryland crops, for range, and as wildlife habitat. Barley and alfalfa-bromegrass hay are the main crops. Some forested areas are used for grazed woodland; some areas are used for recreation, mainly summer cabins; and some areas are being developed for homesites.

After small grains are grown, returning crop residue to the soil helps to maintain structure and tilth and increases the intake of water. Grassed waterways help to control erosion.

CAPABILITY UNIT IIIs–1 DRYLAND

Valleono silty clay loam, the only soil in this unit, is well drained. The surface layer is silty clay loam, and the subsoil is silty clay loam to silty clay. Slopes are 0 to 3 percent.

Permeability is moderately slow. Runoff is slow, and the hazard of erosion is slight. Available water capacity is 5 to 9 inches. Effective rooting depth is 60 inches or more.

This soil is used for native pasture and as wildlife habitat. It is suited to dryland and irrigated crops.

If dryland crops are grown, tillage must be done when the moisture content of the soil is optimum for cultivation. Returning crop residue to the soils helps to maintain organic-matter content and tilth.

CAPABILITY UNIT IIIs–2 DRYLAND

This unit consists of well-drained soils that have a surface layer of gravelly loam, loam, and silt loam. The subsoil or the underlying material is gravelly loam and silt loam to silty clay loam. Slopes are 0 to 3 percent.

Permeability is moderate. Runoff is slow, and the hazard of erosion is slight. Available water capacity is 3 to 10 inches. Effective rooting depth is 60 inches or more.

These soils are mainly used for dryland crops, for range, and as wildlife habitat. Barley and alfalfa-bromegrass hay are the main crops. The soils are also used for recreation.

Returning crop residue to the soil and systematic crop rotations help to maintain organic-matter content, structure, and tilth and increase the intake of water.

CAPABILITY UNIT IIIw–62 DRYLAND

This unit consists of somewhat poorly drained soils that have a surface layer of silt loam. The subsoil or the underlying material is silt loam or silty clay. Slopes are 0 to 3 percent.

Permeability is moderate or moderately slow. Runoff is slow, and the hazard of erosion is slight. Available water capacity is 4 to 11 inches. Effective rooting depth is 60 inches or more. The soils are subject to nondamaging annual floods for short periods in spring and early in summer.

These soils are used for range and native pasture and as wildlife habitat. They are suited to dryland crops, mainly permanent cover crops for hay and pasture.

If these soils are cultivated, returning crop residue to the soil helps to maintain organic-matter content, structure, and tilth and increases the intake of water. Growing a cover of crops helps to protect the soils during periods of flooding.

CAPABILITY UNIT IVe–1 DRYLAND

This unit consists of well-drained soils that have a surface layer of silt loam or silty clay loam. The subsoil is silty clay loam to silty clay. Slopes are 10 to 20 percent.

Permeability is moderately slow. Runoff is medium to rapid, and the hazard of erosion is moderate to high. Available water capacity is 7 to 11 inches. Effective rooting depth is 60 inches or more.

These soils are used for dryland crops, for range, and as wildlife habitat. Barley and alfalfa-bromegrass hay are the main crops.

Some of the soils have a narrow range of moisture content that is optimum for cultivation. Crop rotations and returning crop residue to the soil help to maintain organic-matter content, structure, and tilth and increase the intake of water. Grassed waterways help to control erosion. Crops seeded on the contour also help to control erosion. Stripcropping helps to reduce excessive soil losses.

CAPABILITY UNIT IVe–2 DRYLAND

This unit consists of well-drained soils that have a surface layer of loam or silt loam. The subsoil or the underlying material is silt loam or silty clay loam. Slopes are 10 to 20 percent.

Permeability is moderate. Runoff is medium, and the hazard of erosion is moderate. Available water capacity is 9 to 13 inches. Effective rooting depth is 60 inches or more.

These soils are mainly used for dryland crops, for range, and as wildlife habitat. Barley and alfalfa-bromegrass hay are the main crops. Some forested areas are also used for grazed woodland.

If small grain is grown, crop rotations and returning crop residue to the soil help to maintain organic-matter content, structure, and tilth and to increase the intake of water. Grassed waterways help to control erosion. Crops seeded on the contour or across slopes also help to control erosion. Stripcropping helps to reduce excessive soil losses.

CAPABILITY UNIT Vw–64 DRYLAND

This unit consists of poorly drained and very poorly drained soils. The surface layer and subsoil or underlying material range in texture. Slopes are 0 to 3 percent.

Permeability mainly is slow. Runoff is ponded to slow, and the hazard of erosion is slight. Available water capacity is 3 to 4 inches. Effective rooting depth is 60 inches or more. Seasonal high water table ranges from at or near the surface to a depth of 20 inches. Flooding for short periods in spring and early in summer is a hazard.

These soils are used for native pasture and hay (fig. 11) and as wildlife habitat.

Some areas of these soils can be improved by drainage, fertilization, and seeding with suited water-tolerant grasses and clover. Permanent cover crops help to prevent damage from flooding. Drainage is required to keep the water table at a nearly constant level and help plants grow vigorously.

CAPABILITY UNIT VIe–1 DRYLAND

This unit consists of well drained or somewhat excessively drained soils that have a surface layer mainly of loam, silt loam, clay loam, or silty clay loam. The subsoil or underlying material is mainly sandy loam to clay. Some soils have a gravelly or cobbly surface layer and a gravelly to very gravelly subsoil or underlying material. Slopes are 6 to 30 percent.

Permeability is moderate to slow. Runoff is slow to rapid, and the hazard of erosion is slight to high. Available water capacity is 3 to 13 inches. Effective rooting depth is 60 inches or more.

Most of these soils are used for range, and some are used for grazed woodland. All are suited to wildlife habitat. A few small areas are used for hay, and in a few small areas barley is grown.

Good grazing management is needed to maintain the native plant community and minimize erosion. In most areas seeding and brush control help to improve the native vegetation if it is in a deteriorated condition. Seeded areas can also be fertilized to promote vigorous growth. Woodland areas can also be improved by broadcast seeding if the understory vegetation has been depleted.

CAPABILITY UNIT VIs–9 DRYLAND

This unit consists of somewhat excessively drained soils that have a surface layer of gravelly sandy loam, gravelly loam, or cobbly loam. The subsoil or underlying material is gravelly loam or very gravelly sandy loam. Slopes are 0 to 6 percent.

Permeability is rapid. Runoff is slow, and the hazard of erosion is slight. Available water capacity is 2 to 7 inches. Effective rooting depth is 60 inches or more.

These soils are used as wildlife habitat and for urban development and recreation. They are suited to range.

Good grazing management is needed to maintain the native plant community. The native vegetation can be improved by seeding and brush control if it is in a deteriorated condition. Fertilizer can be used to promote vigorous growth of seeded plants.

CAPABILITY UNIT VIIe–1 DRYLAND

This unit consists of well-drained and somewhat excessively drained soils that have a surface layer of fine

Figure 10.—Native hay of Dipman silty clay loam, which is in capability unit Vw–64 dryland.

sandy loam to silty clay loam. The subsoil or underlying material is loam or clay. Some of these soils are gravelly, cobbly, or very gravelly throughout. Slopes are 6 to 70 percent.

Permeability is moderately rapid to slow. Runoff is slow to rapid, and the hazard of erosion is high. Available water capacity is 1 to 12 inches. Effective rooting depth is 10 inches or more.

Most of these soils are used for range and as wildlife habitat, and some soils are used for grazed woodland. Most areas are too steep, too shallow to bedrock, or too stony to be seeded by conventional methods, and some are too shallow to bedrock or contain too many coarse fragments. Grazing management can be used in areas used for range.

Management of the soils for irrigated farming

Natural moisture in spring is adequate for plants in most years. Irrigation generally begins June 1 because the supply of water is short when the flow of creeks decreases in the latter part of the growing season. Sprinkler systems that use gravity or pumped water are the most efficient means of irrigation. They wet the soils uniformly and use small amounts of water. Barley and alfalfa-bromegrass hay are the main irrigated crops. Some alfalfa is grown alone, but most is mixed with grasses.

Successful irrigated farming depends on keeping enough moisture in the soil at all times so that plants grow normally. The soil is a reservoir that holds water and makes it available for plant growth.

The three major considerations in managing irrigated soils in the Area are maintaining structure, maintaining fertility, and controlling erosion.

Maintaining structure is necessary to provide adequate aeration, desirable water intake rate, and good tilth. Tillage should not be done when the moisture content of the soil is high. A grass-legume mixture in the crop rotation is the most common method of maintaining structure and good tilth. Applying barnyard manure and returning crop residue to the soil add needed organic matter.

The short growing season in Star Valley Area limits crop production more than any other factor. The frost-free season is 30 to 50 days. However, maintaining fertility is important for continued high production. The use of fertilizer and amendments should be based on the needs of the crop to be grown and on the results of soil tests.

Good irrigation water management is needed to control erosion from applied water on many of the irrigated soils. It also helps to control erosion in supply and field ditches. To keep excessive soil losses to a minimum, irrigation ditches should be constructed on a minimum grade and appropriate drop structure should be installed as needed.

Some limitations that affect the soils of the survey area are described in the following paragraphs:

Irrigated soils should be nearly level, but soils as steep as 15 percent can be irrigated if erosion-control measures are used. These measures include irrigation-water management; contour tillage; and use of close-growing vegetation, preferably sod-forming grasses, in the steeper areas. If the slope is more than 15 percent, it is very difficult to keep soil losses low, and therefore, irrigation is not suited.

More than 36 inches of soil depth is desirable for irrigated crops. Soils less than 36 inches deep require more frequent irrigation, have less room for root development, and are generally less productive.

Clayey soils require special treatment because tilth is poor and the intake of water is slow. Tillage must be done when the moisture content is neither too low nor too high. Returning crop residue to the soil is important to maintain or improve tilth and structure.

Coarse fragments, such as gravel, cobbles, or stones, reduce the available water capacity of the soil in proportion to the content. A high content of coarse fragments in a soil can also be a limitation to tillage.

Salinity is not a serious concern in this area but small areas of salt accumulation are along Stump, Webster, and Crow Creeks and in some seep areas north of Auburn.

The presence of a high water table is generally associated with soils on the flood plains. It is related to the level of flow in the adjacent streams. In some places, the high water table is caused by excessive irrigation in higher lying areas. This high water table restricts or limits the growth of plant roots, but in some places in the Area the water table zone is highly aerated and is beneficial, even to deep-rooted crops. Drainage is required to maintain the water table at a constant depth and to lower the water table so that it is not at or near the surface in places.

When plants remove this water, the reservoir needs to be replenished. Water that penetrates beyond the reach of plant roots is lost to the crop, and it also leaches out soluble plant nutrients.

The irrigated capability units are described in the following pages, and suggestions for use and management are given.

CAPABILITY UNIT IIIe–1 IRRIGATED

Paulson silty clay loam, 0 to 3 percent slopes, the only soil in this unit, is well drained. The surface layer is silty clay loam, and the subsoil is silty clay loam to silty clay. Slopes are 0 to 3 percent.

Permeability is moderately slow. Runoff is slow, and the hazard of erosion is slight. Available water capacity is 7 to 11 inches. Effective rooting depth is 60 inches or more.

This soil is used for barley and for alfalfa-bromegrass hay because the growing season is short. It is also suited to wildlife habitat.

Rotating crops and returning crop residue to the soil help to maintain structure, tilth, and organic-matter content and increase the intake of water. Irrigation water can be applied by border irrigation where slopes are 0 to 1 percent. Contour ditches or sprinklers are best suited to areas where slopes are 1 to 3 percent because they help to prevent excessive soil losses. Depth of cuts made when shaping and smoothing fields should be limited to avoid exposing the silty clay subsoil and mixing it into the plow layer. If the subsoil is exposed, the intake of water decreases and cultivation is more difficult.

CAPABILITY UNIT IIIe–2 IRRIGATED

Robana silt loam, 0 to 3 percent slopes, the only soil in this unit, is well drained. The surface layer is silt loam, and the subsoil is silt loam to silty clay loam. Slopes are 0 to 3 percent.

Permeability is moderate. Runoff is slow, and the hazard of erosion is slight. Available water capacity is 11 to 13 inches. Effective rooting depth is 60 inches or more.

This soil is used for barley and for alfalfa-bromegrass hay because the growing season is short. It is suited to wildlife habitat.

Rotating crops and returning crop residue to the soil help to maintain organic-matter content, structure, and tilth and increase the intake of water. Irrigation water can be applied by border irrigation where slopes are 0 to 1 percent. Contour ditches are suited to areas where slopes are 1 to 3 percent, because they help prevent excessive soil losses. Sprinkler irrigation is suited to all areas.

CAPABILITY UNIT IIIe–1 IRRIGATED

Paulson silty clay loam, 3 to 6 percent slopes, the only soil in this unit, is well drained. The surface layer is silty clay loam, and the subsoil is silty clay loam to silty clay. Slopes are 3 to 6 percent.

Permeability is moderately slow. Runoff is slow to medium, and the hazard of erosion is slight to moderate. Available water capacity is 7 to 11 inches. Effective rooting depth is 60 inches or more.

Barley and alfalfa-bromegrass hay are the main crops. The soil is suited to wildlife habitat.

Contour ditches or sprinklers help to prevent excessive soil losses due to irrigation. Rotating crops and returning crop residue to the soil help to maintain organic-matter content, structure, and tilth and increase the intake of water. Drop structures should be installed in irrigation supply ditches to reduce excessive ditch erosion.

CAPABILITY UNIT IIIe–2 IRRIGATED

This unit consists of well-drained soils that have a surface layer of gravelly loam, loam, or silt loam. The subsoil is gravelly loam and silt loam to silty clay loam. Slopes are 3 to 6 percent.

Permeability is moderate. Runoff is slow, and the hazard of erosion is slight. Available water capacity is 3 to 10 inches. Effective rooting depth is 60 inches or more.

Barley and alfalfa-bromegrass hay are the main crops. These soils are also suited to wildlife habitat.

Contour ditches or sprinklers help to prevent excessive soil losses due to irrigation. Rotating crops and returning crop residue to the soil help to maintain organic-matter content, structure, and tilth and increase the intake of water. Depth of cuts, when shaping and smoothing fields, should be limited to avoid exposing the very gravelly underlying material. Drop structures should be installed in irrigation supply ditches to reduce ditch erosion.

CAPABILITY UNIT IIIs–1 IRRIGATED

Valleono silty clay loam, the only soil in this unit, is well drained. The surface layer is silty clay loam, and the subsoil is silty clay loam to silty clay. Slopes are 0 to 3 percent.

Permeability is moderately slow. Runoff is slow, and the hazard of erosion is slight. Available water capacity is 5 to 9 inches. Effective rooting depth is 60 inches or more.

This soil is used for barley and for alfalfa-bromegrass hay. It is also suited to wildlife habitat.

Rotating crops and returning crop residue to the soil help to maintain organic-matter content, structure, and tilth and increase the intake of water. Irrigation water can be applied by border irrigation where slopes are 0 to 1 percent. Contour ditches or sprinklers are suited to areas where slopes are 1 to 3 percent because they help to prevent excessive soil losses. Leveling cuts or smoothing should be limited to avoid exposing the silty clay subsoil.

CAPABILITY UNIT IIIs–2 IRRIGATED

This unit consists of well-drained soils that have a surface layer of gravelly loam, loam, or silt loam. The subsoil or underlying material is gravelly loam, silt loam, or silt loam to silty clay loam. Slopes are 0 to 3 percent.

Permeability is moderate. Runoff is slow, and the hazard of erosion is slight. Available water capacity is 3 to 10 inches. Effective rooting depth is 60 inches or more.

Barley and alfalfa-bromegrass hay are the main crops. The soils are also suited to wildlife habitat.

Rotating crops and returning crop residue to the soil help to maintain organic-matter content, structure, and tilth and increase the intake of water. Irrigation can be applied by border irrigation where slopes are 0 to 1 percent. Contour ditches or sprinklers are suited to areas where slopes are 1 to 3 percent because they help to prevent excessive soil losses. Shaping and smoothing should be limited to prevent exposing the very gravelly underlying material.

CAPABILITY UNIT IIIw–62 IRRIGATED

Turson silt loam, the only soil in this unit, is somewhat poorly drained. The surface layer and the underlying material are silt loam. Slopes are 0 to 3 percent.

Permeability is moderate. Runoff is slow, and the hazard of erosion is slight. Available water capacity is 4 to 10 inches. Effective rooting depth is 60 inches or more. The seasonal high water table is at a depth of 30 to 60 inches. The soil is generally flooded for short periods annually.

Barley and alfalfa-bromegrass hay are the main crops. Because of the water table, alfalfa generally dies out in a few years. This soil is also suited to wildlife habitat.

Rotating crops and returning crop residue to the soil help to maintain organic-matter content, structure, and tilth and increase the intake of water. Border irrigation or sprinkler irrigation are suitable methods for applying irrigation water. This soil should be protected from flooding to prevent crop or soil damage.

CAPABILITY UNIT IVe–1 IRRIGATED

The Buckskin soil in the Buckskin-Decross association, undulating, is the only soil in this unit. It is well drained and has a surface layer of silt loam. The subsoil is silty clay loam. Slopes are 3 to 10 percent.

Permeability is moderately slow. Runoff is slow to medium, and the hazard of erosion is slight to moderate. Available water capacity is 9 to 11 inches. Effective rooting depth is 60 inches or more.

Barley and alfalfa-bromegrass hay are the principal crops.

Sprinkler irrigation is the most suitable method to use to prevent excessive soil losses. Rotating crops and returning crop residue to the soil help to maintain organic-matter content, structure, and tilth and increase the intake of water. Crops should be planted across the slope to help reduce soil losses.

CAPABILITY UNIT IVe–2 IRRIGATED

This unit consists of well-drained soils that have a surface layer of loam or silt loam. The subsoil is silt loam to silty clay loam. Slopes are 3 to 10 percent.

Permeability is moderate. Runoff is slight to medium, and the hazard of erosion is slight to moderate. Available water capacity is 9 to 13 inches. Effective rooting depth is 60 inches or more.

Barley and alfalfa-bromegrass hay are the main crops.

Sprinkler irrigation is the most suitable method to use to prevent erosion. Rotating crops and returning crop residue to the soil help to maintain organic-matter content and structure and increase the intake of water. Crops should be seeded across the slope to help reduce soil losses.

CAPABILITY UNIT IVs–9 IRRIGATED

This unit consists of somewhat excessively drained soils that have a surface layer of gravelly loam and gravelly sandy loam. The subsoil or the underlying material is gravelly loam and very gravelly sandy loam. Slopes are 0 to 6 percent.

Permeability is moderate. Runoff is slow, and the hazard of erosion is slight. Available water capacity is 2 to 7 inches. Effective rooting depth is 60 inches or more.

These soils are used for irrigated crops and pasture. Barley and alfalfa-bromegrass hay are the main crops.

Leveling and smoothing should be limited to avoid exposing the very gravelly underlying material. Applying water by sprinklers is the best method of irrigation (fig. 12). Other systems of irrigation require short runs.

CAPABILITY UNIT Vs–9 IRRIGATED

Hobacker cobbly loam, the only soil in this unit, is somewhat excessively drained. The surface layer is cobbly loam, and the underlying material is gravelly loam. Slopes are 0 to 3 percent.

Permeability is moderate. Runoff is slow, and the hazard of erosion is slight. Available water capacity is 3 to 7 inches. Effective rooting depth is 60 inches or more.

This soil is used for irrigated pasture. It is also suited to wildlife habitat.

Although the surface layer of this soil is cobbly, the

Figure 11.—**Sprinkler system to replace contour ditch system being installed on Greyback gravelly loam, which is in capability unit IVs–9 irrigated.**

soil can be seeded. It responds to fertilization. Sprinkler irrigation is required to obtain even distribution of water. Other methods require short runs and frequent applications to prevent overirrigation and to ameliorate the droughtiness of the soil. The feasibility of smoothing or leveling is very limited because of the very gravelly underlying material.

Predicted yields

The predicted average annual yields per acre for the principal crops grown in the survey area are given in table 2. These yields are for a high level of management.

The following practices are assumed to be a part of the high-level management for dryland crops:

1. Timely management of seeding, tillage, and harvesting.
2. Management of crop residue.
3. Tillage on the contour.
4. Use of terraces and grassed waterways where needed.
5. Use of high-quality seed.
6. Control of weeds, insects, and disease.
7. Alternation of small grain with summer fallow.

For irrigated crops the following practices are assumed to be a part of high-level management:

1. Timely completion of all management operations.
2. Improved management of irrigation water.
3. Use of conservation cropping systems.
4. Use of fertilizer, amendments, and manure in amounts needed by the crop to be grown and as indicated by the result of soil tests.
5. Management of organic residue.
6. Tillage on the contour.
7. Control of weeds, insects, and disease.

The yield predictions in table 2 are based on normal growing conditions for the area. Damage by frost, hail, drought, insect infestations, and floods was not considered. The estimates reflect the inherent differences in soils and their response to management. They were based on data gathered from farmers, county agricultural extension agents, the Wyoming and Idaho Agricultural Experiment Stations, the Agriculture Conservation and Stabilization Service, the Farmers Home Administration, and personnel of the Soil Conservation Service.

Range[4]

About 66,000 acres of Star Valley Area is in range,

[4] DURWOOD E. BALL, BRENT J. HARRISON, and PERRY D. GRUHLKEY, range conservationists, Soil Conservation Service, helped to prepare this section.

and an additional 24,000 acres of woodland is used mainly for grazing. The range is in a narrow border surrounding the irrigated valley floor and in a large block on the west side of the upper valley. Precipitation averages 18 to 21 inches per year in most of the Area.

Livestock operations and seasons of grazing are highly variable. Range, intermingled with crops or hay, is used mainly in the fall after harvest. Other range areas can be used at any time of the year except winter.

Much of the range supplies an important part of the wildlife food, especially in winter. The shallow and stony slopes that face south and west are the most critical wildlife habitat areas in winter.

Range sites and condition classes

Different kinds of soil vary in their capacity to pro-

TABLE 2.—*Predicted average annual yields per acre under a high level of management*

[Dashes indicate that the crop is not suited to the soil or is grown in very small amounts]

Soil	Barley		Alfalfa-bromegrass hay		Native hay
	Irrigated	Dryland	Irrigated	Dryland	
	Bu	*Bu*	*Ton*	*Ton*	*Ton*
Buckskin silt loam					2.0
Buckskin-Decross association, undulating	75	35	4.0		2.0
Buckskin-Decross association, hilly		30			2.0
Cowdrey clay loam, 10 to 30 percent slopes				2.1	
Cryaquolls and Cryaquepts					
Dipman silty clay loam					
Dipman-Narrows association					
Greyback gravelly loam	70		4.0		
Greyback and Hobacker soils, 0 to 30 percent slopes					
Greyback-Rooset association, hilly					
Greyback-Rooset association, steep					
Hobacker gravelly sandy loam					
Hobacker gravelly loam	70		4.0		
Hobacker cobbly loam					
Hobacker-Osmund gravelly loams, 6 to 20 percent slopes					
Hobacker-Osmund gravelly loams, 20 to 30 percent slopes					
Huffine silt loam, 0 to 3 percent slopes	75		3.0		
Huffine silt loam, 3 to 6 percent slopes	75		3.0		
Lail-Cowdrey association					
Leavittville complex	80		4.0		
Osmund and Mundos loams, 0 to 3 percent slopes	80		4.0		
Osmund and Mundos loams, 3 to 6 percent slopes	75		4.0		
Osmund and Mundos gravelly loams, 0 to 3 percent slopes	80		4.0		
Osmund and Mundos gravelly loams, 3 to 6 percent slopes	75		4.0		
Paulson silty clay loam, 0 to 3 percent slopes	80		4.0		
Paulson silty clay loam, 3 to 6 percent slopes	80	35	4.0	2.3	
Paulson silty clay loam, 6 to 10 percent slopes		35		2.1	
Paulson silty clay loam, 10 to 20 percent slopes		30		2.0	
Paulson-Rock land complex, 30 to 60 percent slopes					
Paulson-Lail association					
Paulson-Osmund association					
Paulson-Robana association, hilly		30		2.0	
Paulson-Robana association, steep				1.8	
Redmanson association					
Redmanson-Starley association					
Robana silt loam, 0 to 3 percent slopes	80	40	4.2	2.3	
Robana silt loam, 3 to 10 percent slopes	70	35	4.0	2.1	
Robana silt loam, 10 to 20 percent slopes		30		2.0	
Robana-Turnerville association, undulating	75	35	4.0	2.2	
Robana-Turnerville association, hilly		30		2.0	
Robana-Turnerville association, steep				1.8	
Splitro complex, 6 to 30 percent slopes					
Starley cobbly silty clay loam, 6 to 30 percent slopes					
Starley complex, 6 to 30 percent slopes					
Stony rock land					
Thayne loam, 0 to 3 percent slopes	80		4.0		
Thayne loam, 3 to 6 percent slopes	75		4.0		
Thayne gravelly loam, 0 to 3 percent slopes	80		4.0		
Thayne gravelly loam, 3 to 6 percent slopes	75		4.0		
Turson silt loam	75		3.5		
Valleono silty clay loam	75		4.0		
Willow Creek-Bozeman association, undulating	80	40	4.0	2.3	
Willow Creek-Bozeman association, hilly		35		2.0	

duce grass and other plants for grazing. Soils that produce about the same kinds and amounts of forage, if the range is in similar condition, make up a range site.

Range sites are kinds of range that differ in their ability to produce vegetation. The soils of any one range site produce about the same kind of climax vegetation. Climax vegetation is the stabilized plant community; it reproduces itself and does not change as long as the environment remains unchanged. Throughout the prairie and the plains, the climax vegetation consists of the plants that were growing there when the region was first settled. If cultivated crops are not grown, the most productive combination of forage plants on a range site is generally the climax vegetation.

Decreasers are plants in the climax vegetation that tend to decrease in relative amount under close grazing. They generally are the tallest and most productive perennial grasses and forbs and the most palatable to livestock.

Increasers are plants in the climax vegetation that increase in relative amount as the most desirable decreaser plants are reduced by close grazing. They are commonly shorter than decreasers and are generally less palatable to livestock.

Invaders are plants that cannot compete with plants in the climax plant community for moisture, nutrients, and light. Invaders come in and grow along with increasers after the climax vegetation has been reduced by grazing. Many are annual weeds, and some are shrubs that have some grazing value, but others have little value for grazing.

Four range condition classes are used to indicate the degree of departure from the potential, or climax, vegetation brought about by grazing or other uses. The classes show the present condition of the native vegetation on a range site in relation to the native vegetation that could grow there.

A range is in excellent condition if 76 to 100 percent of the vegetation is of the same kind as that in the climax stand. It is in good condition if the percentage is 51 to 75; in fair condition if the percentage is 26 to 50; and in poor condition if the percentage is less than 25.

Range condition is judged according to standards that apply to the particular range site. It expresses the present kind and amount of vegetation in relation to the climax plant community for that site.

Potential forage production depends on the range site. Current forage production depends on the range condition and the moisture available to plants during their growing season.

A primary objective of good range management is to keep range in excellent or good condition. If this is done, water is conserved, yields are improved, and the soils are protected. The concern is recognizing important changes in the kind of cover on a range site. These changes take place gradually and can be misinterpreted or overlooked. Growth encouraged by heavy rainfall can lead to the conclusion that the range is in good condition, when actually the cover is weedy and the long-term trend is toward lower production. On the other hand, some areas of range that have been closely grazed for short periods, under the supervision of a careful manager, can have a degraded appearance that temporarily conceals its quality and ability to recover.

Descriptions of the range sites

In the following pages, the range sites of Star Valley Area are described and the climax plants and principal invaders on the sites are named. Also given is an estimate of the potential annual yield of air-dry herbage for each site when it is in excellent condition. The soils in each site can be determined by referring to the "Guide to Mapping Units" at the back of this soil survey.

GRAVELLY RANGE SITE

This range site consists of somewhat excessively drained soils that have a surface layer of cobbly loam. The subsoil or underlying material is gravelly loam or very gravelly sandy loam. Slopes are 0 to 30 percent.

Permeability is rapid. Available water capacity is 3 to 7 inches.

Decreasers make up about 50 percent of the climax vegetation. Among the decreasers are western needlegrass, antelope bitterbrush, perennial forbs, and bearded bluebunch wheatgrass. Increasers are prairie junegrass, thickspike wheatgrass, Letterman needlegrass, forbs, Kentucky bluegrass, big sagebrush, and Douglas rabbitbrush.

Under continued heavy grazing, western needlegrass and bearded bluebunch wheatgrass decrease in the plant community. Such plants as prairie junegrass, Kentucky bluegrass, big sagebrush, Douglas rabbitbrush, and forbs increase. If overgrazing is prolonged, forbs and Douglas rabbitbrush make up a substantial part of the annual production, and total production is greatly reduced.

If this site is in excellent condition, the total annual yield of air-dry herbage ranges from 500 pounds per acre in years when moisture is unfavorable to 850 pounds per acre in years when moisture is favorable. About 75 percent of this yield is forage for cattle or sheep.

LOAMY RANGE SITE

This range site consists of well-drained to excessively drained soils that have a surface layer of gravelly loam, loam, silt loam, or silty clay loam. The subsoil or underlying material is very gravelly sandy loam to silty clay. Slopes are 0 to 30 percent.

Permeability is moderately slow to rapid. Available water capacity is 3 to 13 inches.

Decreasers make up about 40 percent of the climax vegetation. Among the decreasers are subalpine needlegrass, basin wildrye, mountain bromegrass, spike fescue, western needlegrass, perennial forbs, antelope bitterbrush, and Canby bluegrass. Increasers are Idaho fescue, Kentucky bluegrass, thickspike wheatgrass, forbs, big sagebrush, Letterman needlegrass, Douglas rabbitbrush, and common snowberry.

Under continued heavy grazing, subalpine needlegrass, basin wildrye, mountain bromegrass, spike fescue, and western needlegrass decrease in the plant community. Such plants as Idaho fescue, Kentucky bluegrass, forbs, and big sagebrush increase. If overgrazing is prolonged, big sagebrush, Douglas rabbitbrush, Kentucky bluegrass, and increaser forbs make up a

substantial part of the annual production, and total production is greatly reduced.

If this site is in excellent condition, the total annual yield of air-dry herbage ranges from 1,400 pounds per acre when moisture is unfavorable to 2,400 pounds per acre in years when moisture is favorable. About 75 percent of this yield is forage for cattle or sheep.

In some places quaking aspen has invaded this site and become the dominant plant. These aspen areas are classified as woodland and are not managed as range.

SHALLOW LOAMY RANGE SITE

This range site consists of well-drained soils that have a surface layer of cobbly silty clay loam. The underlying material is very gravelly silty clay loam, and bedrock is at a depth of 10 to 20 inches. Slopes are 6 to 60 percent.

Permeability is moderate. Available water capacity is 1 to 3 inches.

Decreasers make up about 10 percent of the climax vegetation. Among the decreasers are bearded bluebunch wheatgrass, spike fescue, Canby bluegrass, Idaho fescue, perennial forbs, antelope bitterbrush, and Saskatoon serviceberry. Increasers are thickspike wheatgrass, prairie junegrass, forbs, big sagebrush, Kentucky bluegrass, and snowbrush ceanothus.

Under continued heavy grazing, bearded bluebunch wheatgrass, spike fescue, and Canby bluegrass decrease in the plant community. Such plants as thickspike wheatgrass, prairie junegrass, forbs, Kentucky bluegrass, and big sagebrush increase. If overgrazing is prolonged, big sagebrush, Douglas rabbitbrush, increaser forbs, and Kentucky bluegrass make up a substantial part of the annual production, and total production is greatly reduced.

If this site is in excellent condition, the total annual yield of air-dry herbage ranges from 900 pounds per acre in years when moisture is unfavorable to 1,500 pounds per acre in years when moisture is favorable. About 65 percent of this yield is forage for cattle or sheep.

STEEP LOAMY RANGE SITE

This range site consists of well-drained soils that have a surface layer of gravelly loam, silt loam, or silty clay loam. The subsoil or underlying material is gravelly loam and silty clay loam to silty clay. Slopes are 30 to 60 percent.

Permeability is moderately slow to rapid. Available water capacity is 4 to 12 inches.

Decreasers make up about 35 percent of the climax vegetation. Among the decreasers are Saskatoon serviceberry, bearded bluebunch wheatgrass, perennial forbs, antelope bitterbrush, Canby bluegrass, mountain bromegrass, and spike fescue. Increasers are common chokecherry, forbs, Kentucky bluegrass, common snowberry, thickspike wheatgrass, Idaho fescue, big sagebrush, and Douglas rabbitbrush.

Under continued heavy grazing, bearded bluebunch wheatgrass, Canby bluegrass, and mountain bromegrass decrease in the plant community. Such plants as forbs, Kentucky bluegrass, and big sagebrush increase. If overgrazing is prolonged, Kentucky bluegrass, common chokeberry, common snowberry, sedges, and Douglas rabbitbrush make up a substantial part of the annual production, and total production is greatly reduced.

If this site is in excellent condition, the total annual yield of air-dry herbage ranges from 1,200 pounds per acre in years when moisture is unfavorable to 2,200 pounds per acre in years when moisture is favorable. About 60 percent of this yield is forage for cattle or sheep.

STEEP STONY RANGE SITE

This range site consists of somewhat excessively drained to well-drained soils that have a surface layer of gravelly loam to very gravelly silty clay loam. The subsoil or underlying material is gravelly loam to very gravelly silty clay loam. Slopes are 30 to 60 percent.

Permeability is moderately slow to rapid. Available water capacity is 2 to 6 inches.

Decreasers make up about 50 percent of the climax vegetation. Among the decreasers are bearded bluebunch wheatgrass, antelope bitterbrush, Saskatoon serviceberry, perennial forbs, Canby bluegrass, and Columbia needlegrass. Increasers are forbs, Kentucky bluegrass, prairie junegrass, Sandberg bluegrass, common snowberry, big sagebrush, thickspike wheatgrass, and Douglas rabbitbrush.

Under continued heavy grazing, bearded bluebunch wheatgrass, Canby bluegrass, and Columbia needlegrass decrease in the plant community. Such plants as thickspike wheatgrass, forbs, Kentucky bluegrass, Sandberg bluegrass, prairie junegrass, and big sagebrush increase. If overgrazing is prolonged, big sagebrush, Kentucky bluegrass, Douglas rabbitbrush, and increaser forbs make up a substantial part of the annual production, and total production is greatly reduced.

If this site is in excellent condition, the total annual yield of air-dry herbage ranges from 1,000 pounds per acre in years when moisture is unfavorable to 1,800 pounds per acre in years when moisture is favorable. About 65 percent of this yield is forage for cattle or sheep.

In some places quaking aspen has invaded this site and become the dominant plant. These aspen areas are classified as woodland and not managed as range.

SUBIRRIGATED RANGE SITE

This range site consists of somewhat poorly drained soils that have a surface layer of silt loam. The subsoil or underlying material is silt loam to silty clay. Slopes are 0 to 3 percent.

Permeability is moderate to moderately slow. Available water capacity is 4 to 11 inches. The seasonal high water table is at a depth of 30 to 60 inches.

Decreasers make up about 50 percent of the climax vegetation. Among the decreasers are perennial forbs, slender wheatgrass, tufted hairgrass, Nebraska sedge, and alpine timothy. Increasers are baltic rush, Kentucky bluegrass, forbs, western wheatgrass, mat muhly, shrubby cinquefoil, black willow, and roses.

Under continued heavy grazing, slender wheatgrass and alpine timothy decrease in the plant community. Such plants as Kentucky bluegrass and western wheatgrass increase. If overgrazing is prolonged, black willow, baltic rush, mat muhly, and increaser forbs make up a substantial part of the annual production, and total production is greatly reduced.

When this site is in excellent condition, the total annual yield of air-dry herbage ranges from 3,500 pounds per acre in years when moisture is unfavorable to 5,500 pounds per acre in years when moisture is favorable. About 60 percent of this yield is forage for cattle or sheep.

VERY SHALLOW RANGE SITE

This range site consists of Stony rock land, which is steep to very steep, very stony, and gravelly. Texture and permeability are variable, but depth to bedrock is less than 20 inches.

Decreasers make up about 45 percent of the climax vegetation. Among the decreasers are bearded bluebunch wheatgrass, true mountainmahogany, Canby bluegrass, spike fescue, perennial forbs, and antelope bitterbrush. Increasers are big sagebrush, forbs, thickspike wheatgrass, Sandberg bluegrass, Douglas rabbitbrush, and common snowberry.

Under continued heavy grazing, bearded bluebunch wheatgrass and Canby bluegrass decrease in the plant community. Such plants as Sandberg bluegrass, forbs, and big sagebrush increase. If overgrazing is prolonged, big sagebrush, snowberry, increaser forbs, and Douglas rabbitbrush make up a substantial part of the annual production, and total production is greatly reduced.

If this site is in excellent condition, the total annual yield of air-dry herbage ranges from 600 pounds per acre in years when moisture is unfavorable to 900 pounds per acre in years when moisture is favorable. About 60 percent of this production is forage for cattle or sheep.

WETLAND RANGE SITE

This range site consists of poorly drained to very poorly drained soils. The texture of the surface layer, of the subsoil, and of the underlying material varies from place to place. Slopes are 0 to 3 percent.

Permeability is mainly slow. The seasonal high water table is at a depth of less than 20 inches and often is at or near the surface.

Decreasers make up about 50 percent of the climax vegetation. Among the decreasers are tufted hairgrass, Nebraska sedge, northern reedgrass, perennial forbs. Increasers are baltic rush, black willow, forbs, roses, and bog kalmia.

Under continued heavy grazing, tufted hairgrass and northern reedgrass decrease in the plant community. Such plants as baltic rush and black willow increase. If overgrazing is prolonged, black willow, baltic rush, and increaser forbs make up a substantial part of the annual production, and total production is greatly reduced.

If this site is in excellent condition, the total annual yield of air-dry herbage ranges from 5,000 pounds per acre in years when moisture is unfavorable to 7,000 pounds per acre in years when moisture is favorable. About 65 percent of this production is forage for cattle or sheep.

Wildlife[5]

Star Valley Area is in the heart of one of the best hunting and fishing areas in Wyoming and Idaho. Hunting and fishing guides and outfitters operate out of the towns in the Area. Most of the big game hunting is in the foothills and mountains. Waterfowl hunting is excellent in the Area, and upland game bird hunting is good throughout the Area. Trout fishing is a major recreational pursuit.

The kinds and numbers of wildlife in an area are determined by the kinds and amount of vegetation, which in turn is influenced by soil, topography, and land use. In areas that are generally grazed, for example, the amount of vegetation left in the fall is most important in determining wildlife population.

Drainage and permeability are important in determining the suitability of a soil for various kinds of wildlife habitat. They are also important in planning water developments for fish, waterfowl, and fur bearers.

Topography determines where marshes and fish ponds can be developed. Deep canyons that have steep sides are needed for fish ponds, and shallow basins that have gradually sloping sides are needed for waterfowl developments.

Water developments benefit many species. At least 10 feet of water is needed in winter for the survival of trout when inflow ceases. Developments for waterfowl should have 2 feet or less of water to insure good growth of aquatic and marsh plants. They should be fenced in and protected from grazing animals to provide nesting sites. Marshes, springs, and other natural water areas should be protected and maintained or improved as aquatic and marsh habitat.

The vegetation in this Area provides habitat for a variety of wildlife species. Important game species include elk, mule deer, ruffed grouse, blue grouse, duck, and geese.

The soils of the survey area are grouped into four wildlife habitat types. These coincide with the four major soil associations as defined in the section, "General Soil Map." For more information read the general soil map section and refer to the general soil map. For information about individual soil series read the section, "Descriptions of the Soils."

Wildlife Habitat Type 1 (Hobacker-Greyback-Leavittville association).—This association consists of nearly level to gently sloping, well-drained gravelly loams and loams on alluvial fans and terraces. It covers about 31 percent of the survey area.

These soils are used mainly for irrigated crops. Barley and alfalfa-bromegrass hay are the main crops. Native vegetation consists of bunchgrasses and shrubs. These soils are also used for farmsteads and as townsites and are the most intensively used soils in the survey area.

Wildlife Habitat Type 2 (Turson-Dipman association).—This association consists of nearly level, somewhat poorly drained to very poorly drained soils on flood plains. It covers about 13 percent of the survey area.

These soils are used mainly for native pasture and hay. A few areas are used for irrigated crops. Native vegetation consists of grasses, sedges, rushes, and willows. Most of the water areas in the Area are in this habitat type.

Wildlife Habitat Type 3 (Robana-Buckskin-Cowdrey

[5] JAMES W. JUNE, biologist, Wyoming Game and Fish Commission, helped to prepare this section.

association).—This association consists of rolling and hilly, deep, well-drained loamy soils on foot slopes and uplands. It covers about 22 percent of the survey area.

These soils are used mainly for dryland crops, range, and grazed woodland. A few small areas are used for irrigated crops. Native vegetation consists of bunchgrasses and shrubs in the open areas and trees and an understory of grasses and shrubs in the forested areas.

Wildlife Habitat Type 4 (Paulson-Lail-Stony rock land association).—This association consists of steep to very steep foothills and mountains surrounding the Valley. It covers about 34 percent of the survey area.

These soils are used mainly for range and grazed woodland. Native vegetation consists of bunchgrasses, shrubs, and trees and an understory of bunchgrasses and shrubs.

A few moose are in the national forest lands around the Area and occasionally range into the survey area. A large elk herd is fed during the winter at the feeding grounds near Alpine in the northern end of the Area. This elk herd migrates into the National Forest around the Area in spring and remains there until snow drives them back to the valley late in fall. Mule deer are the most plentiful of the big-game species. Most of them follow a pattern somewhat similar to elk; that is, they spend the summer in the high mountain areas and return to the foothills and the valley late in fall. In winter, they gather on the steep slopes that face south and west where the sun tends to keep some areas bare of snow. These slopes are in wildlife habitat types 3 and 4. As the supply of forage is depleted, the deer move out into the valley into wildlife habitat types 1 and 2.

A few black bear and mountain lion are present in wildlife habitat type 4. Coyotes are not so plentiful as they once were, but a few are in wildlife habitat types 3 and 4. In wildlife habitats 3 and 4 there are a few lynx, bobcat, badger, marten, and mink. Fox are scarce but live throughout the Area. Skunk are common in wildlife habitat types 1, 2, and 3.

Beaver are plentiful in the slower flowing streams that flow out of the mountains west of the valley, especially in areas adjacent to quaking aspen stands in wildlife habitat type 3. A few mink live along the flood plains of wildlife habitat type 2. Muskrat are common in some of the lower-gradient streams and the marshy areas of wildlife habitat type 2.

Ruffed and blue grouse are plentiful in the wooded areas of wildlife habitat types 3 and 4. They also use wildlife habitat types 1 and 2 for brood areas in summer. A few Hungarian and chukar partridges are in wildlife habitat types 1, 2, and 3.

Rabbits are scarce in the Area, but some cottontail rabbits are in wildlife habitat types 1 and 2 and some snowshoe rabbits are in wildlife habitat types 3 and 4.

Waterfowl migrate regularly through the Area, but many remain all year. The Salt River seldom freezes over and thus provides open water for waterfowl throughout the winter. Ducks and geese use wildlife habitat type 2 as a nesting area and feed in the grain fields in wildlife habitat types 1 and 3. Greater sandhill cranes live in wildlife habitat type 2. Trumpeter swans and whistling swans are occasionally seen in wildlife habitat type 2.

A wide variety of songbirds inhabit Star Valley, and redwing blackbirds, starlings, and crows are plentiful in wildlife habitat types 1, 2, and 3. Ravens and magpies are common throughout Star Valley. There are also a few peregrine falcons, golden eagles, and bald eagles.

Salt River, Crow Creek, and other streams are stocked with trout. A fish-rearing station owned and operated by the State of Wyoming and a private trout farm are located on Webster Creek in Idaho where springs provide the necessary water.

Engineering Uses of the Soils

This section is useful to those who need information about soils used as structural material or as foundation upon which structures are built. Among those who can benefit from this section are planning commissions, town and city managers, land developers, engineers, contractors, and farmers.

Among properties of soils highly important in engineering are permeability, strength, compaction characteristics, soil drainage condition, shrink-swell potential, grain size, plasticity, and reaction. Also important are depth to the water table, depth to bedrock, and slope. These properties, in various degrees and combinations, affect construction and maintenance of roads, airports, pipelines, foundations for small buildings, irrigation systems, ponds and small dams, and systems for disposal of sewage and refuse.

Information in this section of the soil survey can be helpful to those who—

1. Select potential residential, industrial, commercial, and recreational areas.
2. Evaluate alternate routes for roads, highways, pipelines, and underground cables.
3. Seek sources of gravel, sand, or clay.
4. Plan farm drainage systems, irrigation systems, ponds, terraces, and other structures for controlling water and conserving soil.
5. Correlate performance of structures already built with properties of the kinds of soil on which they are built, for the purpose of predicting performance of structures on the same or similar kinds of soil in other locations.
6. Predict the trafficability of soils for cross-country movement of vehicles and construction equipment.
7. Develop preliminary estimates pertinent to construction in a particular area.

Most of the information in this section is presented in tables 3, 4, and 5, which show, respectively, several estimated soil properties significant to engineering; interpretations for various engineering uses; and results of engineering laboratory tests on soil samples.

This information, along with the soil map and other parts of this publication, can be used to make interpretations in addition to those given in tables 4 and 6, and it also can be used to make other useful maps.

This information, however, does not eliminate need for further investigations at sites selected for engineering works, especially works that involve heavy loads or that require excavations to depths greater than those shown in the tables, generally depths more than 6 feet. Also, inspection of sites, especially small

ones, is needed because many delineated areas of a given soil mapping unit may contain small areas of other kinds of soil that have strongly contrasting properties and different suitabilities or limitations for soil engineering.

Some of the terms used in this soil survey have special meaning to soil scientists that is not known to all engineers. The Glossary defines many of these terms commonly used in soil science.

Engineering classification systems

The two systems most commonly used in classifying samples of soils for engineering are the Unified system (*9*), used by the Soil Conservation Service, Department of Defense, and other agencies, and the AASHTO system (*1*), adopted by the American Association of State Highway and Transportation Officials.

The Unified system is used to classify soils according to those properties that affect use as a construction material for purposes other than highway construction and maintenance and as a foundation material.

In the Unified system, soils are classified according to particle-size distribution, plasticity, liquid limit, and organic-matter content. Soils are grouped in 15 classes. There are eight classes of coarse-grained soils, identified as GW, GP, GM, GC, SW, SP, SM, and SC; six classes of fine-grained soils, identified as ML, CL, OL, MH, CH, and OH; and one class of highly organic soils, identified as Pt. Soils on the borderline between two classes are designated by symbols for both classes; for example, CL–ML.

The AASHTO system is used to classify soils according to those properties that affect use in highway construction and maintenance. In this system, a soil is placed in one of seven basic groups ranging from A–1 through A–7 on the basis of grain-size distribution, liquid limit, and plasticity index. In group A–1 are gravelly soils of high bearing strength, or the best soils for subgrade (foundation). At the other extreme, in group A–7, are clay soils that have low strength when wet and that are the poorest soils for subgrade. Where laboratory data are available to justify a further breakdown, the A–1, A–2, and A–7 groups are divided as follows: A–1–a, A–1–b, A–2–4, A–2–5, A–2–6, A–2–7, A–7–5, and A–7–6. As additional refinement, the engineering value of a soil material can be indicated by a group index number. Group indexes range from 0 for the best material to 20 or more for the poorest. The AASHTO classification for tested soils, with group index numbers in parentheses, is shown in table 5; the estimated classification, without group index numbers, is given in table 3 for all soils mapped in the survey area.

Soil properties significant to engineering

Several estimated soil properties significant in engineering are given in table 3. These estimates are made for typical soil profiles, by layers sufficiently different to have different significance for soil engineering. The estimates are based on field observations made in the course of mapping, on test data for these and similar soils, and on experience with the same kinds of soil in other counties. Following are explanations of some of the columns in table 3.

Depth to bedrock is distance from the surface of the soil to the upper surface of the rock layer.

Depth to seasonal high water table is distance from the surface of the soil to the highest level that ground water reaches in the soil in most years.

Hydrologic soil groups are groups of soils having similar rates of infiltration, when wetted, and similar rates of water transmission within the soil. The basis of grouping is intake of water at the end of a long-duration storm after prior wetting and opportunity for swelling, without consideration of the protective effect of vegetation. Group A consists of soils that have a high infiltration rate, a high rate of water transmission, and a low runoff potential. In group B are soils that have moderate rates of infiltration and water transmission and moderate runoff potential. Group C soils have slow infiltration rate, slow rate of water transmission, and a high runoff potential. Group D soils have a very slow infiltration rate, a very slow rate of water transmission, and a very high runoff potential.

Potential frost action is the potential effect of the freezing, and subsequent thawing, of soil material. Frost action in soils pertains not only to heaving as freezing progresses, but also to excessive wetting and loss of soil strength upon thawing. Ratings shown in table 3 are moderate and high. A *moderate* rating means that the soil is susceptible to formation of ice lenses, and a *high* rating means the soil is highly susceptible. Either rating indicates frost heave and subsequent loss of strength.

Soil texture is described in table 3 in the standard terms used by the Department of Agriculture. These terms take into account relative percentages of sand, silt, and clay in soil material that is less than 2 millimeters in diameter. "Loam," for example, is soil material that contains 7 to 27 percent clay, 28 to 50 percent silt, and less than 52 percent sand. If the soil contains gravel or other particles coarser than sand, an appropriate modifier is added, as for example, "gravelly loam." "Sand," "silt," "clay," and some of the other terms used in USDA textural classification are defined in the Glossary at the back of this publication.

Liquid limit and plasticity index indicate the effect of water on the strength and consistence of soil material. As the moisture content of a clayey soil is increased from a dry state, the material changes from a semisolid to a plastic state. If the moisture content is further increased, the material changes from a plastic to a liquid state. The plastic limit is the moisture content at which the soil material changes from the semisolid to plastic state; and the liquid limit, from a plastic to a liquid state. The plasticity index is the numerical difference between the liquid limit and the plastic limit. It indicates the range of moisture content within which a soil material is plastic. Liquid limit and plasticity index are estimated in table 3, but in table 5 the data on liquid limit and plasticity index are based on tests of soil samples.

Permeability is that quality of a soil that enables it to transmit water or air. It is estimated on basis of those soil characteristics observed in the field, particularly structure and texture. The estimates in table 3 do not take into account lateral seepage or such transient soil features as plowpans and surface crusts.

Available water capacity is the ability of a soil to

TABLE 3.—*Estimated soil properties*

[An asterisk in the first column indicates that at least one mapping unit in this series is made up of two or more kinds of soil. The instructions for referring to other series that appear in the first column of

Soil series and map symbols	Depth to—		Hydrologic soil group	Potential frost action	Depth from surface	USDA texture	Classification		Coarse fragments greater than 3 inches
	Bedrock	Seasonal high water table					Unified	AASHTO	
	Ft	*In*			*In*				*Pct*
Bozeman	>5	(2)	B	High.	0–9	Silt loam	ML	A–4	0
					9–25	Silty clay loam.	CL	A–6	0
					25–60	Silt loam	ML	A–4	0
Mapped only with Willow Creek soils.									
*Buckskin:									
Bc	>5	3 30–60	C	High.	0–10	Silt loam	CL	A–6	0
					10–32	Silty clay	CH	A–7	0
					32–60	Gravelly clay loam.	GC	A–6	0–5
BDC, BDD	>5	(2)	C	High.	0–9	Silt loam	CL	A–6	0
					9–60	Silty clay	CH	A–7	0
For Decross part of BDC and BDD, see Decross series.									
Cowdrey: COE	>5	(2)	C	High.	0–17	Clay loam	CL	A–6	0–5
					17–40	Clay	CH	A–7	0–5
					40–60	Clay loam	GC or CL	A–7	0–1
Cryaquolls and Cryaquepts: CR.									
Properties too variable to estimate.									
Decross	>5	(2)	B	High.	0–8	Loam	ML–CL, ML	A–4	0
					8–36	Silty clay loam and clay loam.	CL	A–6	0
					36–60	Clay loam	GC, CL	A–6	0–5
Mapped only with Buckskin series.									
*Dipman: Dm, DN	>5	3 7–20	D	High.	0–11	Silty clay loam.	CL	A–7	0
					11–29	Silty clay	CH	A–7	0
					29–60	Very gravelly loam.	GC	A–2	5–10
For Narrows part of DN, see Narrows series.									
*Greyback:									
Gg, GHE (gravelly loam part), GRD, GRE	>5	(2)	B	Moderate.	0–18	Gravelly loam.	GM–GC, SM	A–4	0–25
					18–28	Very gravelly sandy loam.	GM	A–1	0–25
					28–60	Very gravelly loamy sand or sand.	GP, GP–GM	A–1	0–25
For Hobacker part of GHE, see Hc and Hd under Hobacker series. For Rooset part of GRD and GRE, see Rooset series.									
GHE (cobbly loam part)	>5	(2)		Moderate.	0–7	Cobbly loam	GM–GC, ML	A–4	30–50
					7–18	Gravelly loam.	GM–GC, SM	A–4	10–25
					18–28	Very gravelly sandy loam.	GM	A–1	10–25
					28–60	Very gravelly loamy sand or sand.	GP, GP–GM	A–1	10–25

significant to engineering

soils in such mapping units may have different properties and limitations, and for this reason it is necessary to follow carefully the this table. The symbol > means more than; the symbol < means less than]

Percentage less than 3 inches passing sieve—				Liquid limit	Plasticity index	Permeability	Available water capacity	Reaction	Shrink-swell potential	Corrosivity [1]	
No. 4 (4.7 mm)	No. 10 (2.0 mm)	No. 40 (0.42 mm)	No. 200 (0.074 mm)							Uncoated steel	Concrete
				Pct		*In per hr*	*In per in of soil*	*pH*			
100	100	90–100	70–90	30–35	5–10	0.6–2.0	0.19–0.21	6.6–7.8	Low.	Moderate --	Low.
100	100	95–100	85–95	35–40	15–20	0.6–2.0	0.19–0.21	6.6–7.8	Moderate.		
100	100	90–100	70–90	30–35	5–10	0.6–2.0	0.19–0.21	7.4–8.4	Low.		
100	100	90–100	70–90	30–35	10–20	0.6–2.0	0.19–0.21	6.6–7.3	Moderate.	High -----	Low.
100	100	95–100	90–95	50–60	30–40	0.2–0.6	0.15–0.17	6.6–7.3	High.		
60–75	55–70	50–65	40–50	35–40	15–20	0.6–2.0	0.14–0.16	6.6–7.3	Moderate.		
100	100	90–100	70–90	30–35	10–20	0.6–2.0	0.19–0.21	6.6–7.3	Moderate.	High -----	Low.
100	100	95–100	90–95	50–60	30–40	0.2–0.6	0.15–0.17	6.6–7.3	High.		
80–95	75–95	70–90	55–70	35–40	20–25	0.6–2.0	0.14–0.21	6.6–7.3	Moderate.	High -----	Low.
70–95	60–90	55–85	50–75	50–65	30–40	0.06–0.2	0.08–0.14	6.6–7.3	High.		
60–90	50–85	45–80	35–65	40–45	20–25	0.2–0.6	0.09–0.18	6.6–7.3	Moderate.		
80–100	75–100	70–85	50–70	25–35	5–10	0.6–2.0	0.16–0.18	6.6–7.3	Low.	Moderate --	Low.
80–100	75–100	70–95	65–80	35–40	15–20	0.6–2.0	0.19–0.21	6.6–7.8	Moderate.		
60–100	50–100	45–90	40–70	35–40	15–20	0.6–2.0	0.12–0.21	7.9–8.4	Moderate.		
100	100	95–100	85–95	40–45	15–20	0.2–0.6	0.19–0.21	7.4–7.8	Moderate.	High -----	Low.
100	100	95–100	90–95	50–60	25–30	0.06–0.2	0.15–0.17	7.4–7.8	High.		
25–50	15–35	15–30	10–25	25–35	10–15	2.0–6.0	0.06–0.08	7.4–7.8	Low.		
50–80	45–75	4–65	35–50	25–35	5–10	0.6–2.0	0.09–0.14	7.9–8.4	Low.	Low ------	Low.
25–40	20–35	15–25	10–15	[2] NP	[2] NP	6.0–20.0	0.03–0.09	7.9–8.4	Low.		
25–40	20–35	10–20	0–10	NP	NP	6.0–20.0	0.03–0.05	7.9–8.4	Low.		
70–85	65–80	60–75	45–60	25–35	5–10	0.6–2.0	0.11–0.14	7.9–8.4	Low.	Low ------	Low.
50–90	45–85	40–65	35–50	25–35	5–10	0.6–2.0	0.09–0.14	7.9–8.4	Low.		
25–40	20–35	15–25	10–15	NP	NP	6.0–20.0	0.03–0.09	7.9–8.4	Low.		
25–40	20–35	10–20	0–10	NP	NP	6.0–20.0	0.03–0.05	7.9–8.4	Low.		

TABLE 3.—*Estimated soil properties*

Soil series and map symbols	Depth to—		Hydrologic soil group	Potential frost action	Depth from surface	USDA texture	Classification		Coarse fragments greater than 3 inches
	Bedrock	Seasonal high water table					Unified	AASHTO	
	Ft	*In*			*In*				*Pct*
Hobacker:									
Hb	>5	(2)	B	Moderate.	0–23	Gravelly sandy loam.	GM	A–1	0–15
					23–30	Very gravelly sandy loam.	GP–GM	A–1	0–15
					30–60	Very gravelly loamy sand.	GP	A–1	15–30
*Hc, HgD, HOE	>5	(2)	B	Moderate.	0–23	Gravelly loam	GM–GC, SM	A–4	0–15
For Osmond part of HgD and HOE, see OnA and OnB under Osmund series.					23–60	Very gravelly loamy sand.	GP	A–1	15–30
Hd	>5	(2)	B	Moderate.	0–9	Cobbly loam	GM–GC, ML	A–4	25–30
					9–23	Gravelly loam	GM–GC, ML	A–2, A–4	10–15
					23–60	Very gravelly loamy sand.	GP	A–1	15–30
Huffine: HuA, HuB	>5	(2)	B	High.	0–11	Silt loam	ML	A–4	0
					11–31	Silty clay loam.	CL	A–6	0
					31–60	Very gravelly loamy sand.	GP–GM	A–1	15–25
*Lail: LC	>5	(2)	C	High.	0–11	Silt loam	ML	A–4	0
For Cowdrey part, see Cowdrey series.					11–38	Clay	CH	A–7	0
					38–60	Clay loam	CL	A–6	0–15
Leavittville: Le	>5	(2)	B	High.	0–28	Silt loam	ML–CL, ML	A–4	0
					28–60	Very gravelly loam.	GM	A–1	0–25
Mundos (mapped only with Osmund soils):									
Loam part	>5	(2)	B	High.	0–8	Loam	ML–CL, ML	A–4	0
					8–28	Gravelly loam	GM–GC, SM	A–4	0–10
					28–60	Very gravelly loam.	GM	A–1, A–2	10–15
Gravelly loam part	>5	(2)	B	High.	0–28	Gravelly loam	GM–GC, GM	A–4	0–10
					28–60	Very gravelly loam.	GM	A–1, A–2	10–15
Narrows	>5	3 5–20	D	High.	0–20	Silty clay	CH	A–7	0
Mapped only with Dipman soils.					20–60	Gravelly clay loam.	CL	A–7	0
*Osmund:									
*OmA, OmB	>5	(2)	B	High.	0–10	Loam	ML	A–4	0–5
For Mundos part of OmA and OmB, see Loam part under Mundos series.					10–30	Gravelly loam	GM–GC	A–4	5–10
					30–60	Very gravelly loam.	GM, GM–GC	A–1, A–2	10–25

significant to engineering—Continued

Percentage less than 3 inches passing sieve—				Liquid limit	Plasticity index	Permeability	Available water capacity	Reaction	Shrink-swell potential	Corrosivity [1]	
No. 4 (4.7 mm)	No. 10 (2.0 mm)	No. 40 (0.42 mm)	No. 200 (0.074 mm)							Uncoated steel	Concrete
				Pct		*In per hr*	*In per in of soil*	*pH*			
45–75	40–70	25–45	15–25	NP	NP	0.6–2.0	0.05–0.10	7.4–8.4	Low.	Low	Low.
25–40	20–35	10–20	5–10	NP	NP	6.0–20.0	0.04–0.06	7.4–8.4	Low.		
25–45	20–40	5–15	0–15	NP	NP	6.0–20.0	0.03–0.05	7.9–8.4	Low.		
45–80	40–70	40–65	35–50	25–35	5–10	0.6–2.0	0.08–0.14	7.4–8.4	Low.	Low	Low.
25–45	20–40	5–15	0–5	NP	NP	6.0–20.0	0.03–0.05	7.9–8.4	Low.		
55–90	50–90	45–80	35–60	25–35	5–10	0.6–2.0	0.08–0.14	7.4–8.4	Low.	Low	Low.
45–80	40–75	35–70	30–55	25–35	5–10	0.6–2.0	0.08–0.14	7.4–8.4	Low.		
25–45	20–40	5–15	0–5	NP	NP	6.0–20.0	0.03–0.05	7.9–8.4	Low.		
100	100	90–100	70–90	30–35	5–10	0.6–2.0	0.19–0.21	6.6–7.3	Low.	Moderate	Low.
100	100	95–100	85–95	35–40	15–20	0.6–2.0	0.19–0.21	6.6–7.8	Moderate.		
25–35	20–30	15–20	5–10	NP	NP	6.0–20.0	0.03–0.05	7.9–8.4	Low.		
100	100	90–100	70–90	30–35	5–10	0.6–2.0	0.19–0.21	6.1–7.3	Low.	High	Low.
100	100	90–100	75–95	50–65	30–40	0.06–0.2	0.14–0.16	6.1–8.4	High.		
70–100	65–100	60–100	50–80	35–40	15–20	0.2–0.6	0.19–0.21	7.9–8.4	Moderate.		
90–100	90–100	80–90	70–80	25–35	5–10	0.6–2.0	0.19–0.21	7.9–8.4	Low.	High	Low.
25–40	20–35	15–30	15–25	25–35	0–5	2.0–6.0	0.04–0.09	7.9–8.4	Low.		
75–100	75–100	70–90	50–70	25–35	5–10	0.6–2.0	0.14–0.18	6.6–7.8	Low.	Low	Low.
60–75	55–70	50–65	35–50	25–35	5–10	0.6–2.0	0.08–0.13	6.6–7.8	Low.		
25–60	20–55	20–50	15–35	15–35	NP–5	2.0–6.0	0.03–0.08	7.9–8.4	Low.		
60–75	55–70	50–65	35–50	25–35	5–10	0.6–2.0	0.08–0.13	6.6–7.8	Low.	Low	Low.
25–60	20–55	20–50	15–35	15–35	NP–5	2.0–6.0	0.03–0.08	7.9–8.4	Low.		
100	100	95–100	90–95	50–65	30–40	0.06–0.2	0.15–0.17	7.9–9.0	High.	High	Low.
65–80	60–75	55–70	50–60	40–45	20–30	0.06–0.2	0.11–0.16	7.9–9.0	Moderate.		
85–100	80–100	70–90	50–70	25–35	NP–5	0.6–2.0	0.14–0.18	6.6–7.8	Moderate.	Low	Low.
55–75	50–70	45–65	35–50	25–35	5–10	0.6–2.0	0.10–0.15	6.6–7.8	Low.		
25–60	20–55	15–50	15–35	15–25	NP–5	2.0–6.0	0.03–0.12	7.9–8.4	Low.		

TABLE 3.—*Estimated soil properties*

Soil series and map symbols	Depth to—		Hydrologic soil group	Potential frost action	Depth from surface	USDA texture	Classification		Coarse fragments greater than 3 inches
	Bedrock	Seasonal high water table					Unified	AASHTO	
	Ft	*In*			*In*				*Pct*
*OnA, OnB For Mundos part of OnA and OnB, see Gravelly loam part under Mundos series.	>5	(2)	B	High.	0–30 30–60	Gravelly loam Very gravelly loam.	GM–GC GM–GC, GM	A–4 A–1, A–2	5–10 10–25
*Paulson: PaA, PaB, PaC, PaD, PKF, PL, PO, PRD, PRE. Rock land part of PKF is too variable to estimate. For Lail part of PL, see Lail series. For Osmund part of PO, see OnA and OnB under Osmund series. For Robana part of PRD and PRE, see Robana series. For Buckskin part of PRD and PRE, see Buckskin series.	>5	(2)	C	High.	0–5 5–41 41–60	Silt loam Silty clay and silty clay loam. Silt loam	ML–CL, ML CL, CH ML–CL, ML	A–4 A–7 A–4	0 0 0
*Redmanson: RD, RE For Starley part of RE, see Starley series.	>5	(2)	B	Moderate.	0–60	Very gravelly silty clay loam.	GM, GC	A–2	15–25
*Robana: RoA, RoC, RoD, RTC, RTD, RTE. For Turnerville part of RTC, RTD, and RTE, see Turnerville series.	>5	(2)	B	High.	0–20 20–52 52–80	Silt loam Silty clay loam. Silt loam	ML ML, CL CL–ML, CL	A–4 A–4, A–6 A–4, A–6	0 0 0
Rooset Mapped only with Greyback soils.	>5	(2)	B	Moderate.	0–7 7–60	Gravelly loam Very gravelly clay loam.	GM, SM GC	A–2, A–4 A–2	0–15 10–25
Splitro: SPE	1–1½	(2)	D	High.	0–15 15	Fine sandy loam. Sandstone.	SM–SC, SC	A–4	0–50
Starley: SSE, STE	1–1½	(2)	D	High.	0–14 14	Cobbly to very cobbly silty clay loam. Hard limestone.	GM, CL, GC	A–6	25–65
Stony rock land: SY. Properties too variable to estimate.									
Thayne: TeA, TeB	>5	(2)	B	High.	0–12 12–24 24–60	Loam Gravelly loam Very gravelly loam.	ML GM–GC, SM GM	A–4 A–4 A–1, A–2	0 0–10 10–15
ThA, ThB	>5	(2)	B	High.	0–24 24–60	Gravelly loam Very gravelly loam.	GM–GC, SM GM	A–4 A–1, A–2	0–10 10–15

significant to engineering—Continued

Percentage less than 3 inches passing sieve—				Liquid limit	Plasticity index	Permeability	Available water capacity	Reaction	Shrink-swell potential	Corrosivity [1]	
No. 4 4.7 mm)	No. 10 (2.0 mm)	No. 40 (0.42 mm)	No. 200 (0.074 mm)							Uncoated steel	Concrete
				Pct		*In per hr*	*In per in of soil*	*pH*			
55–75	50–70	45–65	35–50	25–35	5–10	0.6–2.0	0.10–0.15	6.6–7.8	Low.	Low ------	Low.
25–60	20–55	15–50	15–35	15–25	NP–5	2.0–6.0	0.03–0.12	7.9–8.4	Low.		
75–100	75–100	70–100	60–90	25–35	5–10	0.6–2.0	0.14–0.21	6.6–7.3	Low.	High -----	Low.
75–100	75–100	70–100	70–95	40–55	20–30	0.2–0.6	0.11–0.17	6.6–8.4	High.		
75–100	75–100	70–100	60–90	25–35	5–10	0.6–2.0	0.14–0.21	7.9–8.4	Low.		
25–45	20–40	20–40	15–35	35–40	10–20	0.6–2.0	0.04–0.08	7.9–8.4	Low.	Moderate --	Low.
95–100	95–100	90–100	85–100	25–35	0–10	0.6–2.0	0.19–0.21	6.6–7.3	Low.	Moderate --	Low.
95–100	95–100	90–100	85–100	30–35	5–15	0.6–2.0	0.19–0.21	6.6–7.3	Moderate.		
95–100	95–100	90–100	85–100	25–35	5–15	0.6–2.0	0.19–0.21	6.6–7.3	Moderate.		
50–80	40–75	35–65	30–50	30–35	5–10	0.6–2.0	0.11–0.13	6.6–7.3	Low.	Moderate --	Low.
40–60	30–50	30–45	25–35	40–50	20–30	0.2–0.6	0.07–0.09	6.6–8.4	Moderate.	Moderate --	Low.
90–100	85–100	60–80	35–50	15–25	5–10	2.0–6.0	0.08–0.15	6.6–7.3	Low.	Low ------	Low.
65–70	60–70	40–65	35–60	35–40	10–20	0.6–2.0	0.06–0.13	7.4–8.4	Moderate.	Moderate --	Low.
75–100	75–100	65–90	50–75	25–35	NP–5	0.6–2.0	0.14–0.18	6.6–7.8	Low.	Low ------	Low.
60–80	55–75	50–65	35–50	25–35	5–10	0.6–2.0	0.10–0.15	7.4–8.4	Low.		
25–60	20–55	20–50	15–35	20–35	NP–5	2.0–6.0	0.03–0.12	7.9–8.4	Low.		
60–80	55–75	50–65	35–50	25–35	5–10	0.6–2.0	0.10–0.15	6.6–8.4	Low.	Low ------	Low.
25–60	20–55	20–50	15–35	20–35	NP–5	2.0–6.0	0.03–0.12	7.9–8.4	Low.		

TABLE 3.—*Estimated soil properties*

Soil series and map symbols	Depth to—		Hydrologic soil group	Potential frost action	Depth from surface	USDA texture	Classification		Coarse fragments greater than 3 inches
	Bedrock	Seasonal high water table					Unified	AASHTO	
	Ft	*In*			*In*				*Pct*
Turnerville Mapped only with Robana soils.	>5	([2])	B	High.	0–30	Silt loam	ML–CL, ML	A–4	0–5
					30–50	Silty clay loam.	CL	A–6	0–5
					50–70	Silt loam	ML	A–4	0–5
Turson: Tu	>5	[3] 30–60	B	High.	0–30	Silt loam	ML–CL, ML	A–4	0–10
					30–60	Very gravelly loamy sand.	GP–GM	A–1	15–25
Valleono: Va	>5	([2])	B	High.	0–9	Silty clay loam.	ML, CL	A–6	0
					9–24	Silty clay	CL, CH	A–7	0–5
					24–60	Very gravelly loamy sand.	GP–GM	A–1	15–25
*Willow Creek: WcC, WcD For Bozeman and Robana parts of WcC and WcD, see the Bozeman and Robana series.	>5	([2])	B	High.	0–10	Silt loam	ML	A–4	0
					10–37	Silty clay loam.	CL	A–6	0
					37–60	Silt loam	ML	A–4	0

[1] Corrosivity ratings given for uncoated steel and concrete generally apply to the entire profile.
[2] Water table is not present within the depth of observation. Normally the depth is 5 feet, unless bedrock is nearer the surface.

hold water for use by most plants. It commonly is defined as the difference between the amount of water in the soil at field capacity and the amount at the wilting point of most crop plants.

Reaction is the degree of acidity or alkalinity of a soil, expressed as pH. The pH value and terms used to describe soil reaction are explained in the Glossary.

Shrink-swell potential is the relative change in volume to be expected of soil material as moisture content changes, that is, the extent to which the soil shrinks as it dries out or swells when it gets wet. Extent of shrinking and swelling is influenced by the amount and kind of clay in the soil. Shrinking and swelling of soils cause much damage to building foundations, roads, and other structures. A *high* shrink-swell potential indicates a hazard to maintenance of structures built in, on, or with material having this rating.

Corrosivity, as used in table 3, pertains to potential soil-induced chemical action that dissolves or weakens uncoated steel or concrete. Rate of corrosion of uncoated steel is related to such soil properties as drainage, texture, total acidity, and electrical conductivity of the soil material. Corrosivity for concrete is influenced mainly by the content of sodium or magnesium sulfate but also by soil texture and acidity. Installations of uncoated steel that intersect soil boundaries or soil horizons are more susceptible to corrosion than installations entirely in one kind of soil or in one soil horizon. A corrosivity rating of *low* means that there is a low probability of soil-induced corrosion damage. A rating of *high* means that there is a high probability of damage, so that protective measures for steel and more resistant concrete should be used to avoid or minimize damage.

Engineering interpretations of the soils

The interpretations in table 4 are based on the estimated engineering properties of soils shown in table 3, on test data for soils in this survey area and others nearby or adjoining, and on the experience of engineers and soil scientists with the soils of the Star Valley Area. In table 4, ratings are used to summarize limitation or suitability of the soils for all listed purposes other than for drainage for crops and pasture, irrigation, ponds and reservoirs, embankments, and grassed waterways. For these particular uses, table 4 lists those soil features not to be overlooked in planning, installation, and maintenance.

Soil limitations are indicated by the ratings slight, moderate, and severe. *Slight* means soil properties generally favorable for the rated use, or in other words, limitations that are minor and easily overcome. *Moderate* means that some soil properties are unfavorable but can be overcome or modified by special planning and design. *Severe* means soil properties so unfavorable and so difficult to correct or overcome as to require major soil reclamation, special designs, or intensive maintenance.

Soil suitability is rated by the terms, *good, fair,* and *poor,* which have, respectively, meanings approximately parallel to the terms slight, moderate, and severe.

significant to engineering—Continued

Percentage less than 3 inches passing sieve—				Liquid limit	Plasticity index	Permeability	Available water capacity	Reaction	Shrink-swell potential	Corrosivity [1]	
No. 4 (4.7 mm)	No. 10 (2.0 mm)	No. 40 (0.42 mm)	No. 200 (0.074 mm)							Uncoated steel	Concrete
				Pct		*In per hr*	*In per in of soil*	*pH*			
90–100	90–100	90–100	80–90	30–35	5–10	0.6–2.0	0.19–0.21	6.1–7.3	Low.	Moderate	Low.
90–100	90–100	90–100	80–95	35–40	15–20	0.6–2.0	0.19–0.21	6.6–7.3	Moderate.		
90–100	90–100	85–100	70–90	30–35	5–10	0.6–2.0	0.19–0.21	6.6–7.3	Low.		
70–100	65–100	60–100	55–90	25–35	5–10	0.6–2.0	0.12–0.21	7.9–8.4	Low.	Moderate	Low.
25–45	20–40	10–25	5–10	NP	NP	6.0–20	0.03–0.05	7.9–8.4	Low.		
100	100	95–100	85–95	35–40	10–20	0.6–2.0	0.19–0.21	6.6–7.3	Moderate.	High	Low.
85–100	85–100	85–100	80–95	40–55	20–30	0.2–0.6	0.15–0.17	7.4–8.4	High.		
25–45	20–40	10–25	5–10	NP	NP	6.0–20	0.03–0.05	7.9–8.4	Low.		
100	100	90–100	70–90	30–35	5–10	0.6–2.0	0.19–0.21	6.6–7.3	Low.	Moderate	Low.
100	100	95–100	85–95	35–40	15–20	0.6–2.0	0.19–0.21	6.6–8.4	Moderate.		
100	100	90–100	70–90	30–35	5–10	0.6–2.0	0.19–0.21	7.9–8.4	Low.		

[1] Buckskin, Dipman, Narrows, and Turson soils are subject to frequent and very brief flooding in May, June, and July.
[2] NP = nonplastic.

Following are explanations of some of the columns in table 4:

Topsoil is used for topdressing an area where vegetation is to be established and maintained. Suitability is affected mainly by ease of working and spreading the soil material as for preparing a seedbed; natural fertility of the material, or its response of plants when fertilizer is applied; and absence of substances toxic to plants. Texture of the soil material and its content of stone fragments affect suitability, but also considered in the ratings is damage that will result at the area from which topsoil is taken.

Sand and gravel are used in great quantities in many kinds of construction. The ratings in table 4 provide guidance about where to look for probable sources. A soil rated as a *good* or *fair* source of sand or gravel generally has a layer at least 3 feet thick, the top of which is within a depth of 6 feet. The ratings do not take into account thickness of overburden, location of the water table, or other factors that affect mining of the materials, nor do they indicate quality of the deposit.

Road fill is soil material used in embankments for roads. The suitability ratings reflect the predicted performance of soil after it has been placed in an embankment that has been properly compacted and provided with adequate drainage and the relative ease of excavating the material at borrow areas.

Local roads and streets, as rated in table 4, have an all-weather surface expected to carry automobile traffic all year. They have a subgrade of underlying soil material; a base of gravel, crushed rock, or soil material stabilized with lime or cement; and a flexible or rigid surface, commonly of asphalt or concrete. These roads are graded to shed water and have ordinary provisions for drainage. They are built mainly from soil at hand, and most cuts and fills are less than 6 feet deep.

Soil properties that most affect design and construction of local roads and streets are load-supporting capacity and stability of the subgrade and the workability and quantity of cut and fill material available. The AASHTO and Unified classifications of the soil material, and also the shrink-swell potential, indicate traffic-supporting capacity. Wetness and flooding affect stability of the material. Slope, depth to hard rock, content of stones and rocks, and wetness affect ease of excavation and amount of cut and fill needed to reach an even grade.

Shallow excavations are those that require digging or trenching to a depth of less than 6 feet, as for example, excavations for pipelines, sewerlines, phone and power transmission lines, basements, open ditches, and cemeteries. Desirable soil properties are good workability, moderate resistance to sloughing, gentle slopes, absence of rock outcrop or big stones, and freedom from flooding or a high water table.

Dwellings, as rated in table 4, are not more than three stories high and are supported by foundation footings placed in undisturbed soil. The features that affect the rating of a soil for dwellings are those that relate to capacity to support load and resist settlement

TABLE 4.—*Interpretations of*

[An asterisk in the first column indicates that at least one mapping unit in this series is made up of two or more kinds of soil. The instructions for referring to other series

Soil series and map symbols	Suitability as a source of—			Degree of soil limitation for—		
	Topsoil	Sand and gravel	Road fill	Local roads and streets	Shallow excavations	Dwellings
Bozeman Mapped only with Willow Creek soils.	Fair where slopes are less than 15 percent: thin surface layer. Poor where slopes are more than 15 percent.	Unsuited	Poor: low strength; hazard of frost action.	Severe: low strength; hazard of frost action.	Slight where slopes are 3 to 8 percent. Moderate where slopes are 9 to 15 percent. Severe where slopes are more than 15 percent.	Moderate where slopes are 3 to 15 percent: expansive; low strength. Severe where slopes are more than 15 percent.
*Buckskin: Bc	Fair: thin surface layer.	Unsuited	Poor: expansive; low strength; hazard of frost action.	Severe: expansive; low strength; hazard of flooding and frost action.	Severe: clayey; hazard of flooding; wetness.	Severe: expansive; hazard of flooding; low strength.
BDC, BDD For Decross part of BDC and BDD, see Decross series.	Fair where slopes are less than 15 percent: thin surface layer. Poor where slopes are more than 15 percent.	Unsuited	Poor: expansive; low strength; hazard of frost action.	Severe: expansive; low strength; hazard of frost action.	Severe: clayey.	Severe: expansive; low strength.
Cowdrey: COE	Fair where slopes are 10 to 15 percent: clayey. Poor where slopes are more than 15 percent.	Unsuited	Poor: expansive; low strength; hazard of flooding and frost action.	Severe: expansive; low strength; hazard of flooding and frost action.	Severe: clayey.	Severe: expansive; low strength.
Cryaquolls and Cryaquepts: CR.	Poor: wetness	Unsuited	Poor: wetness	Severe: hazard of flooding; wetness.	Severe: hazard of flooding; wetness.	Severe: hazard of flooding; wetness.
Decross Mapped only with Buckskin soils.	Fair where slopes are 3 to 5 percent: thin surface layer. Poor where slopes are more than 5 percent.	Unsuited	Poor: low strength.	Severe: low strength; hazard of frost action.	Moderate where slopes are 3 to 15 percent: clayey. Severe where slopes are more than 15 percent.	Moderate where slopes are 3 to 15 percent: expansive; low strength. Severe where slopes are more than 15 percent.
*Dipman: Dm, DN For Narrows part of DN, see Narrows series.	Poor: wetness	Unsuited	Poor: wetness; susceptible to frost action; expansive.	Severe: wetness; hazard of flooding and frost action; expansive.	Severe: wetness; hazard of flooding.	Severe: wetness; hazard of flooding and frost action; expansive.

engineering properties of the soils

soils in such mapping units may have different properties and limitations, and for this reason it is necessary to follow carefully the
that appear in the first column of this table]

Degree of soil limitation for—Continued			Major soil features affecting—				
Sanitary landfill[1] (trench type)	Septic tank absorption field	Sewage lagoons	Pond reservoir areas	Embankments	Drainage for crops and pasture	Irrigation	Grassed waterways
Moderate: clayey.	Moderate where slopes are 3 to 15 percent: restricted permeability. Severe where slopes are more than 15 percent.	Moderate where slopes are 3 to 7 percent: excessive permeability. Severe where slopes are more than 7 percent.	Slope: excessive permeability.	Low strength; hazard of piping.	Slope	Slope	Slope.
Severe: hazard of flooding; clayey; wetness.	Severe: hazard of flooding; wetness; restricted permeability.	Severe: hazard of flooding.	Wetness	Low strength; expansive.	Subject to flooding; wetness.	Wetness; restricted permeability.	Not needed.
Severe: clayey.	Severe: restricted permeability.	Slight where slopes are less than 2 percent. Moderate where slopes are 2 to 7 percent. Severe where slopes are more than 7 percent.	Slope	Low strength; expansive.	Features generally favorable where slopes are less than 3 percent; slope where slopes are more than 3 percent.	Restricted permeability; slope.	Restricted permeability; slope.
Severe: clayey.	Severe: restricted permeability; slope.	Severe: slope.	Slope	Low strength; expansive.	Not needed	Slope; restricted permeability.	Slope.
Severe: hazard of flooding; wetness.	Severe: hazard of flooding; wetness.	Severe: hazard of flooding; wetness.	Wetness		Wetness	Wetness	Not needed.
Moderate where slopes are 3 to 25 percent: clayey. Severe where slopes are more than 25 percent.	Moderate where slopes are 3 to 15 percent: restricted permeability. Severe where slopes are more than 15 percent.	Moderate where slopes are 3 to 7 percent: slope; excessive permeability. Severe where slopes are more than 7 percent.	Slope; excessive permeability.	Low strength; expansive.	Slope	Slope	Slope.
Severe: wetness; hazard of flooding.	Severe: wetness; hazard of flooding; restricted permeability.	Severe: wetness; hazard of flooding.	Wetness	Low strength	Wetness; hazard of flooding; outlets difficult to locate.	Wetness; hazard flooding; restricted permeability.	Not needed.

TABLE 4.—*Interpretations of engineering*

Soil series and map symbols	Suitability as a source of—			Degree of soil limitation for—		
	Topsoil	Sand and gravel	Road fill	Local roads and streets	Shallow excavations	Dwellings
*Greyback: Gg, GHE, GRD, GRE. For Hobacker part of GHE, see Hobacker series. For Rooset part of GRD and GRE, see Rooset series.	Poor: coarse fragments.	Good to fair for gravel.	Good where slopes are 0 to 15 percent. Fair where slopes are 15 to 25 percent. Poor where slopes are more than 25 percent: slope.	Moderate where slopes are 8 to 15 percent. Severe where slopes are more than 15 percent: hazard of frost action.	Severe: coarse fragments.	Slight where slopes are 0 to 8 percent. Moderate where slopes are 8 to 15 percent. Severe where slopes are more than 15 percent.
*Hobacker: Hb, Hc, Hd, HgD, HOE. For Osmund part of HgD and HOE, see Osmund series.	Poor: coarse fragments.	Good for gravel.	Good where slopes are 0 to 15 percent. Fair where slopes are 15 to 25 percent. Poor where slopes are more than 25 percent.	Moderate where slopes are 8 to 15 percent. Severe where slopes are more than 15 percent: hazard of frost action.	Severe: coarse fragments.	Slight where slopes are 0 to 8 percent. Moderate where slopes are 8 to 15 percent. Severe where slopes are more than 15 percent.
Huffine: HuA, HuB	Fair: thin surface layer.	Fair for gravel.	Poor: low strength; hazard of frost action. Good below a depth of 31 inches.	Severe: low strength; hazard of frost action.	Severe: coarse fragments.	Moderate: expansive.
*Lail: LC. For Cowdrey part of LC, see Cowdrey series.	Poor: thin surface layer.	Unsuited	Poor: expansive; low strength; hazard of frost action.	Severe: expansive; hazard of frost action.	Severe: too clayey.	Severe: expansive; low strength.
Leavittville: Le	Good	Poor for gravel.	Poor: hazard of frost action to a depth of 28 inches. Good below a depth of 28 inches.	Severe: hazard of frost action.	Severe: coarse fragments.	Moderate: low strength.
Mundos. Mapped only with Osmund soils.	Poor: coarse fragments; thin surface layer.	Poor for gravel.	Fair: low strength to a depth of 28 inches. Good below a depth of 28 inches.	Severe: hazard of frost action.	Severe: coarse fragments.	Slight

properties of the soils—Continued

Degree of soil limitation for—Continued			Major soil features affecting—				
Sanitary landfill[1] (trench type)	Septic tank absorption field	Sewage lagoons	Pond reservoir areas	Embankments	Drainage for crops and pasture	Irrigation	Grassed waterways
Severe: excessive permeability.	Slight where slopes are 0 to 8 percent: pollution hazard. Moderate where slopes are 8 to 15 percent. Severe where slopes are more than 15 percent.	Severe: coarse fragments; excessive permeability.	Slope; excessive permeability.	Excessive permeability.	Features generally favorable where slopes are less than 3 percent; slope where slopes are more than 3 percent.	Slope; excessive permeability; droughtiness.	Slope; droughtiness.
Severe: excessive permeability.	Slight where slopes are 0 to 8 percent: pollution hazard. Moderate where slopes are 8 to 15 percent. Severe where slopes are more than 15 percent.	Severe	Slope; excessive permeability.	Excessive permeability.	Features generally favorable where slopes are less than 3 percent; slope where slopes are more than 3 percent.	Slope; excessive permeability; droughtiness.	Slope; droughtiness.
Severe: excessive permeability.	Moderate: restricted permeability.	Severe: excessive permeability.	Slope: excessive permeability.	Excessive permeability.	Features generally favorable where slopes are less than 3 percent; slope where slopes are more than 3 percent.	Slope; droughtiness.	Droughtiness.
Severe: too clayey.	Severe: restricted permeability.	Severe: slope.	Slope	Low strength; expansive.		Slope; restricted permeability.	Slope.
Severe: excessive permeability.	Slight	Severe: excessive permeability.	Excessive permeability.	Low strength; hazard of piping.	Features generally favorable.	Droughtiness	Not needed.
Severe: excessive permeability.	Slight	Severe: excessive permeability.	Excessive permeability.	Low strength; hazard of piping.	Features generally favorable where slopes are less than 3 percent; slope where slopes are more than 3 percent.	Droughtiness	Droughtiness.

TABLE 4.—*Interpretations of engineering*

Soil series and map symbols	Suitability as a source of—			Degree of soil limitation for—		
	Topsoil	Sand and gravel	Road fill	Local roads and streets	Shallow excavations	Dwellings
Narrows Mapped only with Dipman soils.	Poor: wetness; too clayey.	Unsuited	Poor: wetness; hazard of frost action; low strength; expansive.	Severe: wetness; hazard of flooding and frost action; low strength; expansive.	Severe: wetness; hazard of flooding.	Severe: wetness; hazard of flooding.
*Osmund: OmA, OmB, OnA, OnB. For Mundos part of OmA, OmB, OnA, and OnB, see Mundos series.	Fair in nongravelly part: thin surface layer; coarse fragments. Poor in gravelly part: coarse fragments.	Unsuited	Good where slopes are 0 to 15 percent: hazard of frost action to a depth of 30 inches; good below a depth of 30 inches. Fair where slopes are 15 to 25 percent. Poor where slopes are more than 25 percent.	Moderate where slopes are 0 to 15 percent: hazard of frost action. Severe where slopes are more than 15 percent.	Severe: coarse fragments.	Slight where slopes are 0 to 8 percent. Moderate where slopes are 8 to 15 percent.
*Paulson: PaA, PaB, PaC, PaD, PKF, PL, PO, PRD, PRE. For Buckskin part of PRD and PRE, see Buckskin series. For Lail part of PL, see Lail series. For Osmund part of PO see Osmund series. For Robana part of PRD and PRE, see Robana series. For Rock land part of PKF, see Stony rock land.	Moderate where slopes are 0 to 15 percent: too clayey. Severe where slopes are more than 15 percent.	Unsuited	Poor: expansive; low strength; hazard of frost action.	Severe: expansive; low strength; hazard of frost action.	Severe: too clayey.	Severe: expansive.
*Redmanson: RD RE For Starley part of RE see Starley series.	Poor: coarse fragments.	Unsuited	Poor: slope	Severe: slope.	Severe: slope.	Severe: slope
*Robana: RoA, RoC, RoD, RTC, RTD, RTE. For Turnerville part of RTC, RTD, and RTE, see Turnerville series.	Good where slopes are 0 to 8 percent. Fair where slopes are 8 to 15 percent. Poor where slopes are more than 15 percent.	Unsuited	Good where slopes are 0 to 25 percent: hazard of frost action. Poor where slopes are more than 25 percent: hazard of frost action.	Moderate where slopes are 0 to 15 percent: hazard of frost action. Severe where slopes are more than 15 percent: hazard of frost action.	Slight where slopes are 0 to 8 percent. Moderate where slopes are 8 to 15 percent. Severe where slopes are more than 15 percent.	Moderate where slopes are 0 to 15 percent: expansive. Severe where slopes are more than 15 percent.

properties of the soils—Continued

Degree of soil limitation for—Continued			Major soil features affecting—				
Sanitary landfill[1] (trench type)	Septic tank absorption field	Sewage lagoons	Pond reservoir areas	Embankments	Drainage for crops and pasture	Irrigation	Grassed waterways
Severe: wetness; hazard of flooding.	Severe: wetness; hazard of flooding: restricted permeability.	Severe: wetness; hazard of flooding.	Wetness	Low strength; expansive.	Wetness; hazard of flooding; outlets difficult to locate.	Wetness; restricted permeability; hazard of flooding.	Not needed.
Severe: excessive permeability.	Slight where slopes are 0 to 8 percent. Moderate where slopes are 8 to 15 percent. Severe where slopes are more than 15 percent.	Moderate where slopes are 0 to 7 percent: excessive permeability. Severe where slopes are more than 7 percent.	Slope; excessive permeability.	Hazard of piping.	Features generally favorable where slopes are less than 3 percent; slope where slopes are more than 3 percent.	Slope; droughtiness.	Slope; droughtiness.
Severe: too clayey.	Severe: restricted permeability.	Slight where slopes are 0 to 2 percent. Moderate where slopes are 2 to 7 percent. Severe where slopes are more than 7 percent.	Slope	Low strength; expansive.	Features generally favorable where slopes are less than 3 percent; slope where slopes are more than 3 percent.	Features generally favorable where slopes are less than 3 percent; slope where slopes are more than 3 percent.	Slope.
Severe: slope.	Severe: slope.	Severe: slope.	Slope	Slope	Not needed	Slope	Slope.
Moderate where slopes are 0 to 25 percent: too clayey. Severe where slopes are more than 25 percent.	Moderate where slopes are 0 to 15 percent: restricted permeability. Severe where slopes are more than 15 percent.	Moderate where slopes are 0 to 7 percent: excessive permeability. Severe where slopes are more than 7 percent.	Slope; excessive permeability.	Low strength; expansive.	Features generally favorable where slopes are less than 3 percent; slope where slopes are more than 3 percent.	Features generally favorable where slopes are less than 3 percent; slope where slopes are more than 3 percent.	Slope.

TABLE 4.—*Interpretations of engineering*

Soil series and map symbols	Suitability as a source of—			Degree of soil limitation for—		
	Topsoil	Sand and gravel	Road fill	Local roads and streets	Shallow excavations	Dwellings
Rooset Mapped only with Greyback soils.	Poor: thin surface layer; coarse fragments.	Unsuited	Good where slopes are 10 to 15 percent. Fair where slopes are 15 to 25 percent. Poor where slopes are more than 25 percent.	Moderate where slopes are 10 to 15 percent: hazard of frost action. Severe where slopes are more than 15 percent.	Severe: coarse fragments.	Moderate where slopes are 10 to 15 percent. Severe where slopes are more than 15 percent.
Splitro: SPE	Poor: thin surface layer.	Unsuited	Poor: thin surface layer.	Severe: shallow to bedrock; slope.	Severe: shallow to bedrock.	Severe: shallow to bedrock.
Starley: SSE, STE	Poor: thin surface layer; coarse fragments.	Unsuited	Poor: thin surface layer.	Severe: shallow to bedrock.	Severe: shallow to bedrock.	Severe: shallow to bedrock.
Stony rock land: SY	Poor: slope; coarse fragments.	Unsuited	Poor: slope; stoniness; thin surface layer.	Severe: slope; stoniness; shallow to bedrock.	Severe: slope; stoniness; shallow to bedrock.	Severe: slope; stoniness; shallow to bedrock.
Thayne: TeA, TeB, ThA, ThB.	Fair: nongravelly; thin surface layer. Poor: gravelly; coarse fragments.	Poor for gravel	Severe: hazard of frost action to a depth of 24 inches; good below that depth.	Severe: hazard of frost action.	Severe: coarse fragments.	Slight
Turnerville Mapped only with Robana soils.	Good where slopes are 3 to 8 percent. Fair where slopes are 8 to 15 percent. Poor where slopes are more than 15 percent.	Unsuited	Good where slopes are 3 to 25 percent: hazard of frost action. Poor where slopes are more than 25 percent: hazard of frost action.	Moderate where slopes are 3 to 15 percent: hazard of frost action. Severe where slopes are more than 15 percent: hazard of frost action.	Slight where slopes are 3 to 8 percent. Moderate where slopes are 8 to 15 percent. Severe where slopes are more than 15 percent.	Moderate where slopes are 3 to 15 percent: expansive; low strength. Severe where slopes are more than 15 percent.
Turson: Tu	Good	Fair for gravel	Poor: hazard of frost action below a depth of 30 inches; good below that depth.	Severe: hazard of flooding and frost action.	Severe: coarse fragments; hazard of flooding.	Severe: hazard of flooding.
Valleono: Va	Fair: too clayey.	Fair for gravel	Poor: expansive; low strength to a depth of 24 inches; good below that depth.	Severe: expansive; low strength.	Severe: coarse fragments.	Severe: expansive; low strength.

properties of the soils—Continued

Degree of soil limitation for—Continued			Major soil features affecting—				
Sanitary landfill[1] (trench type)	Septic tank absorption field	Sewage lagoons	Pond reservoir areas	Embankments	Drainage for crops and pasture	Irrigation	Grassed waterways
Moderate where slopes are 10 to 25 percent: too clayey. Severe where slopes are more than 25 percent.	Severe: restricted permeability.	Severe: slope.	Slope	Low strength	Not needed	Slope; droughtiness.	Slope; droughtiness.
Severe: shallow to bedrock.	Severe: shallow to bedrock.	Severe: shallow to bedrock.	Shallow to bedrock; slope.	Thin surface layer.	Not needed	Slope; shallow rooting depth.	Slope; shallow rooting depth.
Severe: shallow to bedrock.	Severe: shallow to bedrock; slope.	Severe: shallow to bedrock; slope.	Slope; shallow to bedrock.	Thin surface layer.	Not needed	Shallow rooting depth; slope.	Shallow rooting depth; slope.
Severe: slope; stoniness; shallow to bedrock.	Severe: slope; stoniness; shallow to bedrock.	Severe: slope; coarse fragments; shallow to bedrock.	Slope; shallow to bedrock.	Stoniness; shallow to bedrock.	Not needed	Slope; stoniness; shallow to bedrock.	Slope; stoniness; shallow to bedrock.
Severe: excessive permeability.	Slight	Severe: excessive permeability.	Excessive permeability.	Hazard of piping.	Features generally favorable where slopes are less than 3 percent; slope where slopes are more than 3 percent.	Droughtiness	Droughtiness.
Slight where slopes are 3 to 15 percent. Moderate where slopes are 15 to 25 percent. Severe where slopes are more than 25 percent.	Moderate where slopes are 3 to 15 percent: restricted permeability. Severe where slopes are more than 15 percent.	Moderate where slopes are 3 to 7 percent: excessive permeability. Severe where slopes are more than 7 percent.	Slope; excessive permeability.	Low strength; hazard of piping.	Slope	Slope	Slope.
Severe: hazard of flooding; excessive permeability.	Severe: hazard of flooding.	Severe: excessive permeability; hazard of flooding.	Excessive permeability.	Low strength; excessive permeability; hazard of piping.	Outlets difficult to locate; hazard of flooding.	Wetness	Not needed.
Severe: excessive permeability.	Slight: hazard of pollution.	Severe: excessive permeability.	Excessive permeability.	Low strength; expansive to a depth of 24 inches; excessive permeability below a depth of 24 inches.	Features generally favorable.	Droughtiness; restricted infiltration.	Not needed.

TABLE 4.—*Interpretations of engineering*

Soil series and map symbols	Suitability as a source of—			Degree of soil limitation for—		
	Topsoil	Sand and gravel	Road fill	Local roads and streets	Shallow excavations	Dwellings
*Willow Creek: WcC, WcD. For Bozeman and Robana parts of WcC and WcD, see their respective series.	Fair where slopes are 3 to 15 percent: thin surface layer. Poor where slopes are more than 15 percent.	Unsuited ------	Poor: hazard of frost action.	Moderate where slopes are 3 to 15 percent: hazard of frost action. Severe where slopes are more than 15 percent.	Slight where slopes are 3 to 8 percent. Moderate where slopes are 8 to 15 percent. Severe where slopes are more than 15 percent.	Moderate where slopes are 3 to 15 percent: expansive; low strength. Severe where slopes are more than 15 percent.

TABLE 5.—*Engineering*

[Tests made by Materials Testing Laboratory,

Soil name and location	Parent material	Depth	Moisture density [1]		Mechanical analysis [2]			
					Percentage passing sieve—			
			Maximum dry density	Optimum moisture	3 in	2 in	1½ in	1 in
		In	*Lb per cu ft*	*Pct*				
Hobacker gravelly loam: Corner of 2nd Street and Monroe Avenue, Afton, Wyoming. (Nonmodal) [4]	Alluvium.	2–13	103.0	16.5	100	91	90	84
		20–50	----------	----------	100	85	62	44
		50–70	----------	----------	100	89	70	57
Osmund gravelly loam: 195 feet S and 95 feet W of NE corner of NW¼ SW¼ sec. 7, T. 32 N., R. 118 W. (Nonmodal) [4]	Alluvium.	0–9	101.0	19.0	----------	----------	100	99
		20–28	116.0	11.5	----------	----------	100	87
		37–65	125.0	10.6	100	93	83	69
Paulson silty clay loam: 710 feet S and 290 feet E of NW corner of NE¼NE¼ sec. 33, T. 32 N., R. 119 W. (Nonmodal) [4]	Alluvium.	11–18	93.7	25.0	----------	----------	----------	----------
		39–54	105.5	20.5	----------	----------	----------	----------
		77–89	114.0	15.9	----------	----------	----------	----------
Robana silt loam: 840 feet S and 70 feet E of NW corner of sec. 36, T. 35 N., R. 119 W. (Nonmodal) [4]	Wind-laid silt.	5–16	104.6	18.2	----------	----------	----------	----------
		16–27	107.3	17.9	----------	----------	----------	----------
		56–76	109.2	17.0	----------	----------	----------	----------

[1] Based on AASHTO Designation: T 99–70 Method A (*1*).

[2] Mechanical analyses according to the AASHTO Designation: T 88–70 (*1*). Results by this procedure may differ somewhat from results obtained by the soil survey procedure of the Soil Conservation Service (SCS). In the AASHTO procedure, the fine material is analyzed by the hydrometer method, and the various grain-size fractions are calculated on the basis of all the material, including that coarser than 2 millimeters in diameter. In the SCS soil survey procedure, the fine material is analyzed by the pipette method,

properties of the soils—Continued

Degree of soil limitation for—Continued			Major soil features affecting—				
Sanitary landfill[1] (trench type)	Septic tank absorption field	Sewage lagoons	Pond reservoir areas	Embankments	Drainage for crops and pasture	Irrigation	Grassed waterways
Moderate: too clayey.	Moderate where slopes are 3 to 15 percent: restricted permeability. Severe where slopes are more than 15 percent.	Moderate where slopes are 3 to 7 percent: excessive permeability. Severe where slopes are more than 7 percent.	Slope; excessive permeability.	Low strength; hazard of piping.	Slope	Slope	Slope.

[1] Onsite deep studies of the underlying strata, water table, and hazards of aquifer pollution and drainage into ground water should be made for landfill deeper than 5 or 6 feet.

test data

Wyoming Highway Department]

Mechanical analysis [2]—Continued						Liquid limit	Plasticity index	Classification	
Percentage passing sieve—Continued									
¾ in	⅜ in	No. 4 (4.7 mm)	No. 10 (2.0 mm)	No. 40 (0.42 mm)	No. 200 (0.074 mm)			AASHTO [3]	Unified
81	74	69	64	54	36.7	38	7	A–4(0)	SM
34	23	17	12	5	2.9	[5] NP	NP	A–1–a(0)	GP
49	35	25	17	7	2.9	19	NP	A–1–a(0)	GW
97	92	90	80	73	54.8	34	NP	A–4(4)	ML
80	67	57	54	49	37.6	29	8	A–4(1)	GC
62	48	37	35	31	20.6	23	NP	A–1–b(0)	GM
----------	----------	----------	----------	100	94.9	47	22	A–7–6(14)	CL
----------	----------	100	98	97	88.6	41	22	A–7–6(13)	CL
----------	----------	100	99	96	78.3	27	10	A–4(8)	CL
----------	----------	----------	----------	100	98.8	29	6	A–4(8)	ML–CL
----------	----------	----------	----------	100	98.8	31	11	A–6(8)	CL
----------	----------	----------	----------	100	97.7	30	12	A–6(9)	CL

and the material coarser than 2 millimeters in diameter is excluded from calculations of grain-size fractions. The mechanical analyses used in this table are not suitable for use in naming textural classes of soils.

[3] Based on AASHTO Designation M 145–49 (*1*).

[4] This soil is nonmodal. The main difference between this profile and the modal profile is the thickness of some of the horizons and the location from which samples were taken.

[5] NP—nonplastic.

under load and those that relate to ease of excavation. Soil properties that affect capacity to support load are wetness, susceptibility to flooding, density, plasticity, texture, and shrink-swell potential. Those that affect excavation are wetness, slope, depth to bedrock, and content of stones and rocks.

Sanitary landfill is a method of disposing of refuse in dug trenches. The waste is spread in thin layers, compacted, and covered with soil throughout the disposal. Landfill areas are subject to heavy vehicular traffic. Some soil properties that affect suitability for landfill are ease of excavation, hazard of polluting ground water, and trafficability. The best soils have moderately slow permeability, withstand heavy traffic, and are friable and easy to excavate. Unless otherwise stated the ratings in table 4 apply only to a depth of about 6 feet; and, therefore, limitation ratings of *slight* or *moderate* may not be valid if trenches are to be much deeper than that. For some soils reliable predictions can be made to a depth of 10 or 15 feet; but, regardless of that, every site should be investigated before it is selected.

Septic tank absorption fields are subsurface systems of tile or perforated pipe that distribute effluent from a septic tank into natural soil. The soil material between depths of 18 inches and 6 feet is evaluated. The soil properties considered are those that affect both absorption of effluent and construction and operation of the system. Properties that affect absorption are permeability, depth to water table or rock, and susceptibility to flooding. Slope is a soil property that affects difficulty of layout and construction and also the risk of soil erosion, lateral seepage, and downslope flow of effluent. Large rocks or boulders increase construction costs.

Sewage lagoons are shallow ponds constructed to hold sewage, within a depth of 2 to 5 feet, long enough for bacteria to decompose the solids. A lagoon has a nearly level floor and sides or embankments of compacted soil material. The assumption is made that the embankment is compacted to medium density and the pond is protected from flooding. Properties are considered that affect the pond floor and the embankment. Those that affect the pond floor are permeability, organic-matter content, and slope. And if the floor needs to be leveled, depth to bedrock becomes important. The soil properties that affect the embankment are the engineering properties of the embankment material as interpreted from the Unified Soil Classification and the amount of stones, if any, that influence the ease of excavation and compaction of the embankment material.

Pond reservoir areas hold water behind a dam or embankment. Soils suitable for pond reservoir areas have low seepage, which is related to their permeability and depth to fractured or permeable bedrock or other permeable material.

Embankments require soil material resistant to seepage and piping and of favorable stability, shrink-swell potential, shear strength, and compactibility. Presence of stones or organic material in a soil are among factors that are unfavorable.

Drainage for crops and pasture is affected by such soil properties as permeability, texture, and structure; depth to claypan, rock, or other layers that influence rate of water movement; depth to the water table; slope; stability in ditch banks; susceptibility to stream overflow; salinity or alkalinity; and availability of outlets for drainage.

Irrigation of a soil is affected by such features as slope; susceptibility to stream overflow, water erosion, or soil blowing; texture; content of stones; accumulations of salts and alkali; depth of root zone; rate of water intake at the surface; permeability of soil layers below the surface layer and in fragipans or other layers that restrict movement of water; amount of water held available to plants; and need for drainage or depth to water table or bedrock.

Grassed waterways are affected by such features as slope, texture, permeability of soil layers below the surface layer, depth of root zone, available water capacity, accumulation of salts and alkali, presence of stones, and water erosion.

Soil test data

Table 5 contains engineering test data for some of the major soil series in the Star Valley Area. These tests were made to help to evaluate the soils for engineering purposes. The engineering classifications given are based on data obtained by mechanical analyses and by tests to determine liquid limits and plastic limits. The mechanical analyses were made by combined sieve and hydrometer methods.

Compaction (or moisture-density) data are important in earthwork. If a soil material is compacted at successively higher moisture contents, assuming that the compactive effort remains constant, the density of the compacted material increases until the *optimum moisture content* is reached. After that, density decreases with increase in moisture content. The highest dry density obtained in the compactive test is termed *maximum dry density*. As a rule, maximum strength of earthwork is obtained if the soil is compacted to the maximum dry density.

Tests to determine liquid limit and plastic limit measure the effect of water on the consistence of soil material as has been explained for table 3.

General descriptions of the soils shown in table 5 are given in the section "Descriptions of the Soils." Technical descriptions of the profiles sampled follow:

Profile of Hobacker gravelly loam in basement excavation, at corner of Second Street and Monroe Avenue, Afton, Lincoln County:

A11—0 to 2 inches, brown (7.5YR 5/4) gravelly loam, dark brown (7.5YR 3/2) moist; moderate, very fine, granular structure; soft, very friable, slightly sticky and slightly plastic; abundant very fine and micro roots; about 25 percent, by volume, gravel and 20 percent clay; no effervescence; abrupt, wavy boundary.

A12—2 to 13 inches, brown (7.5YR 5/4) gravelly loam, dark brown (7.5YR 3/2) moist; weak, fine, subangular blocky structure parting to weak, very fine, granular; soft, very friable, slightly sticky and slightly plastic; plentiful micro, very fine, and fine roots; common very fine interstitial pores; about 25 percent, by volume, gravel and 20 percent clay; no effervescence; clear, wavy boundary.

A13—13 to 20 inches, brown (7.5YR 5/4) very gravelly loam, dark brown (7.5YR 3/2) moist; weak, fine, subangular blocky structure parting to weak, very fine, granular; soft, very friable, slightly sticky and slightly plastic; some secondary lime on undersides of gravel; plentiful micro, very fine, and

fine roots; common very fine interstitial pores; about 50 percent, by volume, gravel and cobbles and about 20 percent clay; no effervescence; clear, wavy boundary.

Cca—20 to 50 inches, light-brown (7.5YR 6/4) very gravelly and cobbly loam, dark brown (7.5YR 4/2) moist; single grained; loose, nonsticky and nonplastic; secondary lime coatings on gravel, cobbles, and stones; few micro and fine roots; about 90 percent, by volume, gravel and cobbles; violent effervescence; gradual, wavy boundary.

C2—50 to 70 inches, light-brown (7.5YR 6/4) very gravelly and cobbly loam, dark brown (7.5YR 4/2) moist; single grained; loose, nonsticky and nonplastic; very little visible secondary carbonates; few micro and fine roots; about 90 percent, by volume, gravel and cobbles; violent effervescence.

Profile of Osmund gravelly loam, 3 miles north of Afton, 195 feet south and 95 feet west of northeast corner of NW¼SW¼ sec. 7, T. 32 N., R. 118 W., Lincoln County:

Ap—0 to 9 inches, dark-brown (7.5YR 4/2) gravelly loam, very dark brown (7.5YR 2/2) moist; weak, very fine, subangular blocky structure; soft, friable, sticky and plastic; many micro to fine, common medium, and few coarse roots; 15 percent rounded fragments less than 19 millimeters in diameter; noncalcareous; neutral; clear, smooth boundary.

A3—9 to 20 inches, brown (7.5YR 5/2) gravelly loam, dark brown (7.5YR 3/2) moist; weak, medium and fine, subangular blocky structure; slightly hard, friable, sticky and plastic; many micro to fine, common medium, and few coarse roots; 15 percent rounded fragments less than 19 millimeters in diameter; neutral; gradual, wavy boundary.

B2—20 to 28 inches, brown (7.5YR 5/3) gravelly clay loam, dark brown (7.5YR 3/3) moist; weak, medium and fine, subangular blocky structure; slightly hard, friable, sticky and plastic; common very fine to fine and few medium to coarse roots; 20 percent rounded fragments less than 19 millimeters in diameter and 5 percent between 19 and 76 millimeters; noncalcareous; mildly alkaline; gradual, wavy boundary.

B3ca—28 to 37 inches, brown (7.5YR 5/4) very gravelly clay loam, dark brown (7.5YR 3/4) moist; weak, fine, subangular blocky structure; slightly hard, friable, sticky and plastic; 30 percent rounded fragments less than 19 millimeters in diameter, 20 percent between 19 and 76 millimeters; lime coatings on some fragments; calcareous; moderately alkaline; gradual, wavy boundary.

C1ca—37 to 65 inches, light-brown (5YR 6/3) very gravelly loam, brown (7.5YR 5/3) moist; massive; loose, friable, nonsticky and nonplastic; 45 percent rounded fragments less than 19 millimeters in diameter, 20 percent between 19 and 76 millimeters, 5 percent more than 76 millimeters; lime coatings on most of the fragments; calcareous; moderately alkaline; gradual, wavy boundary.

C2—65 to 77 inches, pinkish-gray (5YR 6/2) gravelly loam, dark reddish gray (5YR 4/2) moist; weak, fine, subangular blocky structure; soft, friable, slightly sticky and slightly plastic; 30 percent rounded fragments less than 19 millimeters in diameter; calcareous; moderately alkaline.

Profile of Paulson silty clay loam, 3 miles west of Afton, 710 feet south and 290 feet east of northwest corner of NE¼NE¼ sec. 33, T. 32 N., R. 119 W., Lincoln County:

Ap—0 to 11 inches, dark reddish-gray (5YR 4/2) silty clay loam, dark reddish brown (5YR 2/2) moist; moderate, medium, granular structure; hard, friable, very sticky and plastic; many micro to coarse roots; noncalcareous; mildly alkaline; abrupt, smooth boundary.

A12—11 to 18 inches, dark reddish-gray (5YR 4/2) silty clay loam, dark reddish brown (5YR 2/2) moist; weak, medium, subangular blocky structure parting to moderate, very fine, subangular blocky; hard, friable, very sticky and plastic; many micro to coarse roots; common very fine tubular pores; many earthworm castings; noncalcareous; mildly alkaline; gradual, wavy boundary.

B1—18 to 31 inches, dark reddish-gray (5YR 4/2) silty clay, dark reddish brown (5YR 2/2) moist; weak, fine, prismatic structure parting to moderate, fine and very fine, subangular blocky; very hard, very firm, very sticky and plastic; common micro to coarse roots; common very fine tubular pores; noncalcareous; mildly alkaline; clear, wavy boundary.

B21t—31 to 39 inches, reddish-gray (5YR 5/2) clay, dark reddish brown (5YR 3/3) moist; weak, medium, prismatic structure parting to moderate, medium and fine, subangular blocky; very hard, very firm, very sticky and plastic; few very fine to coarse roots; many very fine to medium tubular pores; common thin clay films on ped faces; noncalcareous; mildly alkaline; gradual, wavy boundary.

B22t—39 to 54 inches, reddish-gray (5YR 5/2) clay, dark reddish brown (5YR 3/3) moist; weak, medium, prismatic structure parting to moderate, medium and fine, subangular blocky; very hard, very firm, very sticky and plastic; few very fine to coarse roots; many very fine to medium tubular pores; many thin clay films on ped faces; noncalcareous; mildly alkaline; clear, wavy boundary.

B3—54 to 64 inches, reddish-brown (2.5YR 5/4) silty clay loam, dark red (2.5YR 3/6) moist; weak, medium, prismatic structure parting to weak, fine and very fine, subangular blocky; hard, friable, very sticky and plastic; very few very fine roots; many very fine to medium tubular pores; noncalcareous; mildly alkaline; clear, wavy boundary.

C1ca—64 to 77 inches, pale-red (2.5YR 6/2) silty clay loam, reddish brown (2.5YR 4/4) moist; weak, very fine, subangular blocky structure; hard, friable, very sticky and plastic; common very fine to medium tubular pores; secondary lime disseminated; calcareous; moderately alkaline; gradual, wavy boundary.

C2ca—77 to 89 inches, pale-red (2.5YR 6/2) silty clay loam, reddish brown (2.5YR 4/4) moist; massive; hard, friable, sticky and plastic; common very fine to medium tubular pores; secondary lime disseminated; calcareous; moderately alkaline.

Profile of Robana silt loam, 2½ miles east of Freedom, 840 feet south and 70 feet east of northwest corner of sec. 36, T. 35 N., R. 119 W., Lincoln County:

Ap—0 to 5 inches, grayish-brown (10YR 5/2) silt loam, very dark grayish brown (10YR 3/2) moist; moderate, fine, granular structure; soft, very friable, slightly sticky and slightly plastic; many very fine to medium roots; noncalcareous; neutral; abrupt, smooth boundary.

A12—5 to 16 inches, brown (10YR 5/3) silt loam, dark brown (10YR 3/3) moist; moderate, fine, subangular blocky structure; slightly hard, very friable, sticky and slightly plastic; many to common very fine to medium roots; noncalcareous; neutral; clear, wavy boundary.

B21t—16 to 27 inches, brown (7.5YR 5/2) silty clay loam, dark brown (7.5YR 4/2) moist; weak, fine, prismatic structure parting to strong, medium and fine, subangular blocky; hard, firm, sticky and plastic; few very fine to fine roots; few, thin, patchy clay films on ped faces; some gray coatings on peds; noncalcareous; neutral; gradual, wavy boundary.

B22t—27 to 34 inches, brown (7.5YR 5/3) silty clay loam, dark brown (7.5YR 4/3) moist; weak, medium, prismatic structure parting to strong, medium and fine, angular blocky; hard, firm, very sticky and plastic; few very fine to fine roots; thin patchy clay films on all ped faces; gray coatings on peds; noncalcareous; neutral; clear, smooth boundary.

B3—34 to 56 inches, light-brown (7.5YR 6/3) silty clay loam, dark brown (7.5YR 4/3) moist; weak, coarse,

angular blocky structure parting to moderate, fine, angular blocky; hard, friable, sticky and plastic; few patchy clay films on some ped faces; few gray coatings on peds; noncalcareous; neutral; gradual, wavy boundary.

C—56 to 76 inches, light-brown (7.5YR 6/4) silty clay loam, dark brown (7.5YR 4/4) moist; weak, coarse to fine, angular blocky structure; slightly hard, friable, very sticky and plastic; noncalcareous; mildly alkaline; clear, wavy boundary.

IIB2t—76 to 104 inches, brown (7.5YR 5/4) silty clay, dark brown (7.5YR 4/4) moist; weak, coarse, prismatic structure parting to weak, coarse, angular blocky; hard, firm, very sticky and plastic; thin nearly continuous clay films; noncalcareous; mildly alkaline; abrupt, wavy boundary.

Recreation

Knowledge of soils is necessary in planning, developing, and maintaining areas used for recreation. In table 6 the soils of Star Valley Area are rated according to limitations that affect their suitability for camp areas, picnic areas, playgrounds, and paths and trails.

In table 6 the soils are rated as having slight, moderate, or severe limitations for the specified uses. For all of these ratings it is assumed that a good cover of vegetation can be established and maintained. A limitation of *slight* means that soil properties are generally favorable and limitations are so minor that they easily can be overcome. A *moderate* limitation can be overcome or modified by planning, by design, or by special maintenance. A *severe* limitation means that costly soil reclamation, special design, intensive maintenance, or a combination of these is required.

Camp areas are used intensively for tents and small camp trailers and the accompanying activities of outdoor living. Little preparation of the site is required other than shaping and leveling for tent and parking areas. Camp areas are subject to heavy foot traffic and limited vehicular traffic. The best soils have mild slopes, good drainage, a surface free of rocks and coarse fragments, freedom from flooding during periods of heavy use, and a surface that is firm after rains but not dusty when dry.

Picnic areas are attractive natural or landscaped tracts used primarily for preparing meals and eating outdoors. These areas are subject to heavy foot traffic. Most of the vehicular traffic, however, is confined to access roads. The best soils are firm when wet but not dusty when dry, are free of flooding during the season of use, and do not have slopes or stoniness that greatly increases cost of leveling sites or of building access roads.

Playgrounds are areas used intensively for baseball, football, badminton, and similar organized games. Soils suitable for this use need to withstand intensive foot traffic. The best soils have a nearly level surface free of coarse fragments and rock outcrop, good drainage, freedom from flooding during periods of heavy use, and a surface that is firm after rains but not dusty when dry. If grading and leveling are required, depth to rock is important.

Paths and trails are used for local and cross-country travel by foot or horseback. Design and layout should require little or no cutting and filling. The best soils are at least moderately well drained, are firm when wet but not dusty when dry, are flooded not more than once during the season of use, have slopes of less than 15 percent, and have few or no rocks or stones on the surface.

Formation and Classification of the Soils

This section discusses the major factors of soil formation as they relate to the soils in Star Valley Area. The current system of soil classification is explained, and the soil series are placed in higher categories of the system.

Factors of Soil Formation

Soil characteristics depend on parent material, climate, plants and animals, relief, and time. Parent material and relief are the results of geological processes. Climate and plants and animals are the active forces of soil formation; they act on the parent material over periods of time. All five factors influenced the formation of the soils in the survey area, but the relative importance of each factor differs with different soils.

Parent material

The soils in the Star Valley Area formed in several kinds of parent material. These parent materials include residuum, colluvium, alluvium, and wind-deposited silt, or loess.

Residuum is mineral material accumulated by the weathering of bedrock in place. It is the parent material for some of the mountain soils. Splitro soils formed in a thin mantle of residuum from sandstone, and Starley soils formed in residuum from limestone.

Colluvium is unconsolidated material that has rolled or been moved downslope from its point of origin through the pull of gravity or local wash. Some soils on steep mountains formed in this material. Lail soils formed in colluvium from red-bed shale and sandstone, and Redmanson soils formed in very gravelly colluvium from limestone.

Alluvium is material deposited by streams on flood plains, stream terraces, and alluvial fans. It is quite variable. Valleono soils and some Paulson soils formed in moderately fine textured alluvium from red-bed shale and sandstone on alluvial fans and terraces. Narrows soils formed in fine-textured alluvium on flood plains. Greyback and Hobacker soils formed in parent material characterized by a thin mantle of gravelly loam alluvium over very gravelly sand alluvium on fans and terraces.

Wind-deposited silt blanketed most of the valley and lower mountain slopes at one time, but subsequent erosion removed all of it except that along the foothills surrounding the valley and a few remnants as isolated ridges or small hills on the valley floor. Bozeman and Robana soils formed in this wind-deposited silt.

Climate

The climate in Star Valley Area is classified as a cold climate with humid winters. It has been an active force in the accumulation of parent material, mainly through the transportation and redeposition of uncon-

TABLE 6.—*Soil limitations and features that affect recreation*

Soil series and map symbols	Camp areas	Picnic areas	Playgrounds	Paths and trails
Bozeman Mapped only with Willow Creek soils.	Slight if slopes are less than 8 percent. Moderate if slopes are 8 to 15 percent. Severe if slopes are more than 15 percent.	Slight if slopes are less than 8 percent. Moderate if slopes are 8 to 15 percent. Severe if slopes are more than 15 percent.	Slight if slopes are less than 2 percent. Moderate if slopes are 2 to 6 percent. Severe if slopes are more than 6 percent.	Slight if slopes are less than 15 percent. Moderate if slopes are 15 to 20 percent.
Buckskin: Bc	Severe: hazard of flooding.	Moderate: hazard of flooding.	Severe: hazard of flooding.	Moderate: hazard of flooding.
BDC BDD For Decross part of BDC and BDD, see Decross series.	Moderate if slopes are less than 15 percent: restricted permeability. Severe if slopes are more than 15 percent.	Slight if slopes are less than 8 percent. Moderate if slopes are 8 to 15 percent. Severe if slopes are more than 15 percent.	Moderate if slopes are less than 6 percent: restricted permeability. Severe if slopes are more than 15 percent.	Slight if slopes are less than 15 percent. Moderate if slopes are 15 to 20 percent.
Cowdrey: COE	Moderate if slopes are less than 15 percent: too clayey; restricted permeability. Severe if slopes are more than 15 percent.	Moderate if slopes are less than 15 percent: too clayey. Severe if slopes are more than 15 percent.	Severe: slope	Moderate if slopes are less than 15 percent: too clayey. Severe if slopes are more than 15 percent.
Cryaquolls and Cryaquepts: CR.	Severe: wetness; hazard of flooding.	Severe: wetness	Severe: wetness; hazard of flooding.	Severe: wetness.
Decross Mapped only with Buckskin soils.	Slight if slopes are 3 to 8 percent. Moderate if slopes are 8 to 15 percent. Severe if slopes are more than 15 percent.	Slight if slopes are 3 to 8 percent. Moderate if slopes are 8 to 15 percent. Severe if slopes are more than 15 percent.	Moderate if slopes are 3 to 6 percent. Severe if slopes are more than 6 percent.	Slight if slopes are 3 to 15 percent. Moderate if slopes are 15 to 25 percent. Severe if slopes are more than 25 percent.
Dipman: Dm, DN For Narrows part of DN, see Narrows series.	Severe: wetness; hazard of flooding.	Severe: wetness	Severe: wetness; hazard of flooding.	Severe: wetness.
Greyback: Gg, GHE, GRD, GRE. For Hobacker part of GHE, see Hobacker series. For Rooset part of GRD and GRE, see Rooset series.	Moderate if slopes are less than 15 percent: coarse fragments. Severe if slopes are more than 15 percent.	Moderate if slopes are less than 15 percent: coarse fragments. Severe if slopes are more than 15 percent.	Severe: coarse fragments.	Moderate if slopes are less than 25 percent: coarse fragments. Severe if slopes are more than 25 percent.
Hobacker: Hb, Hc, Hd, HgD, HOE. For Osmund part of HgD and HOE, see Osmund series.	Moderate if slopes are less than 15 percent: coarse fragments. Severe if slopes are more than 15 percent.	Moderate if slopes are less than 15 percent: coarse fragments. Severe if slopes are more than 15 percent.	Severe: coarse fragments.	Moderate if slopes are less than 25 percent: coarse fragments. Severe if slopes are more than 25 percent.
Huffine: HuA, HuB	Slight	Slight	Slight if slopes are less than 2 percent. Moderate if slopes are 2 to 6 percent.	Slight.
Lail: LC For Cowdrey part, see Cowdrey series.	Slight if slopes are 6 to 8 percent. Moderate if slopes are 8 to 15 percent. Severe if slopes are more than 15 percent.	Slight if slopes are 6 to 8 percent. Moderate if slopes are 8 to 15 percent. Severe if slopes are more than 15 percent.	Severe: slope	Slight if slopes are 6 to 15 percent. Moderate if slopes are 15 to 25 percent. Severe if slopes are more than 25 percent.
Leavittville: Le	Slight	Slight	Slight if slopes are less than 2 percent. Moderate if slopes are 2 to 3 percent.	Slight.

TABLE 6.—*Soil limitations and features that affect recreation*—Continued

Soil series and map symbols	Camp areas	Picnic areas	Playgrounds	Paths and trails
Mundos Mapped only with Osmund soils.	Slight: nongravelly Moderate: gravelly; coarse fragments.	Slight: nongravelly Moderate: gravelly; coarse fragments.	Moderate: nongravelly. Severe: gravelly; coarse fragments.	Slight: nongravelly. Moderate: gravelly; coarse fragments.
Narrows Mapped only with Dipman soils.	Severe: wetness; hazard of flooding.	Severe: wetness	Severe: wetness; hazard of wetness.	Severe: wetness.
Osmund: OmA, OmB, OnA, OnB. For Mundos part, see Mundos series.	Slight: nongravelly Moderate if slopes are less than 15 percent: gravelly; coarse fragments. Severe if slopes are more than 15 percent.	Slight: nongravelly Moderate if slopes are less than 15 percent: gravelly; coarse fragments. Severe if slopes are more than 15 percent.	Slight if slopes are less than 2 percent: nongravelly. Moderate if slopes are 2 to 6 percent: nongravelly. Severe: gravelly; coarse fragments.	Slight: nongravelly. Moderate if slopes are less than 25 percent: gravelly; coarse fragments. Severe if slopes are more than 25 percent.
Paulson: PaA, PaB, PaC, PaD, PKF, PL, PO, PRD, PRE. Rock land part of PKF is too variable to rate. For Lail part of PL, see Lail series. For Osmund part of PO, see Osmund series. For Robana part of PRD and PRE, see Robana series. For Buckskin part of PRD and PRE, see Buckskin series.	Moderate if slopes are less than 15 percent: too clayey; restricted permeability. Severe if slopes are more than 15 percent.	Moderate if slopes are less than 15 percent: too clayey. Severe if slopes are more than 15 percent.	Moderate if slopes are less than 6 percent: too clayey; restricted permeability. Severe if slopes are more than 6 percent.	Moderate if slopes are less than 25 percent: too clayey. Severe if slopes are more than 25 percent.
Redmanson: RD, RE For Starley part of RE, see Starley series.	Severe: slope	Severe: slope	Severe: slope	Severe: slope.
Robana: RoA, RoC, RoD, RTC, RTD, RTE. For Turnerville part of RTC, RTD, and RTE, see Turnerville series.	Slight if slopes are less than 8 percent. Moderate if slopes are 8 to 15 percent. Severe if slopes are more than 15 percent.	Slight if slopes are less than 8 percent. Moderate if slopes are 8 to 15 percent. Severe if slopes are more than 15 percent.	Slight if slopes are less than 2 percent. Moderate if slopes are 2 to 6 percent. Severe if slopes are more than 6 percent.	Slight if slopes are less than 15 percent. Moderate if slopes are 15 to 25 percent. Severe if slopes are more than 25 percent.
Rooset Mapped only with Greyback soils.	Moderate if slopes are 10 to 15 percent: coarse fragments. Severe if slopes are more than 15 percent.	Moderate if slopes are 10 to 15 percent: coarse fragments. Severe if slopes are more than 15 percent.	Severe: slope	Moderate if slopes are 10 to 25 percent: coarse fragments. Severe if slopes are more than 25 percent.
Splitro: SPE	Moderate if slopes are 6 to 15 percent. Severe if slopes are more than 15 percent.	Moderate if slopes are 6 to 15 percent. Severe if slopes are more than 15 percent.	Severe: slope; shallow to bedrock.	Slight if slopes are 6 to 15 percent. Moderate if slopes are 15 to 25 percent. Severe if slopes are more than 25 percent.
Starley: SSE, STE	Moderate if slopes are 6 to 15 percent: coarse fragments; too clayey. Severe if slopes are more than 15 percent.	Moderate if slopes are 6 to 15 percent: coarse fragments; too clayey. Severe if slopes are more than 15 percent.	Severe: slope; shallow to bedrock; coarse fragments.	Moderate if slopes are 6 to 25 percent: coarse fragments; too clayey. Severe if slopes are more than 25 percent.
Stony rock land: SY	Severe: slope; stoniness.	Severe: slope; stoniness.	Severe: slope; stoniness.	Severe: slope; stoniness.

TABLE 6.—*Soil limitations and features that affect recreation*—Continued

Soil series and map symbols	Camp areas	Picnic areas	Playgrounds	Paths and trails
Thayne: TeA, TeB TnA, ThB.	Slight: nongravelly Moderate: gravelly; coarse fragments.	Slight: nongravelly Moderate: gravelly; coarse fragments.	Moderate: coarse fragments.	Slight: nongravelly. Moderate: gravelly; coarse fragments.
Turnerville Mapped only with Robana soils.	Slight if slopes are 3 to 8 percent. Moderate if slopes are 8 to 15 percent. Severe if slopes are more than 15 percent.	Slight if slopes are 3 to 8 percent. Moderate if slopes are 8 to 15 percent. Severe if slopes are more than 15 percent.	Moderate if slopes are 3 to 6 percent. Severe if slopes are more than 6 percent.	Slight if slopes are 3 to 15 percent. Moderate if slopes are 15 to 25 percent. Severe if slopes are more than 25 percent.
Turson: Tu	Severe: hazard of flooding.	Moderate: hazard of flooding.	Severe: hazard of flooding.	Moderate: hazard of flooding.
Valleono: Va	Moderate: too clayey	Moderate: too clayey	Moderate: too clayey	Moderate: too clayey.
Willow Creek: WcC, WcD. For Bozeman and Robana parts, see Bozeman and Robana series.	Slight if slopes are 3 to 8 percent. Moderate if slopes are 8 to 15 percent. Severe if slopes are more than 15 percent.	Slight if slopes are 3 to 8 percent. Moderate if slopes are 8 to 15 percent. Severe if slopes are more than 15 percent.	Moderate if slopes are 3 to 6 percent. Severe if slopes are more than 6 percent.	Slight if slopes are 3 to 15 percent. Moderate if slopes are 15 to 20 percent.

solidated material by streams and local wash. The climate has been an important factor in determining the kind and amount of plant and animal life that existed in the area.

Soil temperatures on steep slopes that face north are cooler than soil temperatures on the valley floor, and soil temperatures on steep slopes that face south are warmer than those on the valley floor. This difference in temperatures and effective moisture have promoted the development of different vegetative communities.

The accumulation of snow in winter protects the soil from the deep penetration of frost, and in spring most of the moisture from snowmelt infiltrates into the soil. Many of the summer rains are slow and gentle, and this moisture also infiltrates readily into the soil.

Relief, time, and parent material modify the effects of climate on such soil-forming processes as leaching and translocation of clay.

Many of the young soils such as Starley, Redmanson, and Leavittville soils have not been leached. All of the mature soils have been leached. Paulson soils have been leached to a depth of 15 to 40 inches, and Robana soils have been leached to a depth of 60 inches or more. The mature soils—Bozeman, Buckskin, Cowdrey, Decross, Huffine, Lail, Paulson, Robana, Rooset, Turnerville, Valleono, and Willow Creek soils—have a zone of clay accumulation. This accumulation results from the formation of clay minerals in place, the removal of clay from the surface layer by water, and the deposition of clay as the rate of percolation slows down.

Plants and animals

The Area generally can be divided into two vegetative communities: grasslands and forested areas. Soils that have a dark-colored surface layer, such as Greyback and Osmund soils, formed under grass. Turnerville and Lail soils have a thin surface layer and a light-colored subsurface layer formed under forest.

The grassland area can be subdivided into grass-sagebrush and rush-sedge-willow communities. These subdivisions are related to the natural drainage of the soils. The forested areas can be subdivided into quaking aspen and ponderosa pine-Douglas-fir communities. Soils that formed under quaking aspen cover have a darker-colored subsurface layer than soils that formed under ponderosa pine-Douglas-fir cover.

The influence of micro-organisms, earthworms, and rodents depends on local climatic conditions. Rodents and earthworms mix the soil horizons in many places but have been especially active in the soils that formed in wind-deposited silt.

Relief

Relief influences soil formation through its effect on runoff and drainage. Not only is slope gradient important, but the direction a slope faces also influences soil formation.

When all other factors are equal, runoff is greater and soil-forming processes, such as leaching and translocation of clay, are slower on steep soils than on gentle slopes. Nearly level soils and soils in swales have slow runoff and often receive additional moisture as run-in from higher-lying areas. The extra moisture causes more leaching and weathering of minerals.

Soils in low-lying areas near streams and lakes commonly have restricted drainage and a high water table. Dipman and Narrows soils have gray or mottled color caused by a high water table and restricted drainage. Narrows soils also have a high content of calcium carbonate, caused by restricted drainage.

The effects of aspect, or direction a slope faces, are very noticeable in canyons in the Gannett Hills. Dark-colored Paulson soils, which formed under grass, are on canyon walls that face south, and light-colored Lail soils, which formed under forest cover, are on slopes that face north.

Time

A long time is needed for most soils to develop genetic horizons. The length of time varies with climate, vegetation, parent material, and relief. The old, or mature, soils in the Star Valley Area have distinct horizons. Bozeman, Decross, Huffine, Paulson, Rooset, Valleono, and Willow Creek soils have accumulations of organic matter, clay, and calcium carbonate. Buckskin and Robana soils have accumulations of organic matter and clay but are leached of calcium carbonate. Other mature soils, such as Cowdrey, Lail, and Turnerville soils, have a light-colored, leached subsurface layer and an accumulation of clay.

Young, or immature, soils either lack distinct horizons or have only one or two. For example, Leavittville and Turson soils have a dark-colored surface layer and accumulations of organic matter but do not have a zone of clay accumulation.

Classification of the Soils

Soils are classified so that their significant characteristics are more easily remembered. Classification enables knowledge about the soils to be assembled, their relationship to one another and to the whole environment to be understood, and principles to understand their behavior and their response to manipulation to be developed. First through classification, and then through use of soil maps, knowledge of soils can be applied to specific fields and other tracts of land.

The narrow categories of classification, such as those used in a detailed soil survey, are useful in managing farms, fields, and woodlands; in developing rural areas; in engineering work; and in many other ways. Soils are placed in broad classes to facilitate study and comparison in large areas such as countries and continents.

The system of soil classification currently used was adopted by the National Cooperative Soil Survey in 1965. Because this system is under continual study, readers interested in developments of the current system should search the latest literature available (*7*).

The current system of classification has six categories. Beginning with broadest, these categories are order, suborder, great group, subgroup, family, and series. In this system the criteria used as a basis for classification are soil properties that are observable and measurable (*4*). The properties are chosen, however, so that the soils of similar genesis, or mode of origin are grouped. In table 7 the soil series of the Star Valley Area are placed in four categories of the current system and also in the great soil group according to the 1938 system (*2*) as revised in 1949 (*5*). Classes of the current system are briefly defined in the following paragraphs:

ORDER: Ten soil orders are recognized. The properties used to differentiate orders are those that tend to give broad climatic groupings of soils. The two exceptions to this are the Entisols and Histosols, which occur in many different climates. Each order is named by a word of three or four syllables ending in *sol* (Moll-i-sol).

TABLE 7.—*Classification of soil series*

Series	Family	Subgroup and great group	Order	Great soil group (1938 classification)
Bozeman	Fine-silty, mixed	Argic Pachic Cryoborolls	Mollisols	Chernozems.
Buckskin [1]	Fine, montmorillonitic	Argic Cryoborolls	Mollisols	Brunizems.
Cowdrey	Fine, montmorillonitic	Typic Cryoboralfs	Alfisols	Gray Wooded soils.
Decross	Fine-loamy, mixed	Argic Pachic Cryoborolls	Mollisols	Chernozems.
Dipman	Clayey over loamy-skeletal, montmorillonitic	Typic Cryaquolls	Mollisols	Humic Gleys.
Greyback	Loamy-skeletal, mixed	Typic Cryoborolls	Mollisols	Chernozems.
Hobacker	Loamy-skeletal, mixed	Pachic Cryoborolls	Mollisols	Chernozems.
Huffine	Fine-silty over sandy or sandy-skeletal, mixed	Argic Cryoborolls	Mollisols	Chernozems.
Lail	Fine, montmorillonitic	Typic Cryoboralfs	Alfisols	Gray Wooded soils.
Leavittville	Fine-loamy, mixed	Pachic Cryoborolls	Mollisols	Chernozems.
Mundos	Fine-loamy, mixed	Pachic Cryoborolls	Mollisols	Chernozems.
Narrows	Fine, montmorillonitic	Calcic Cryaquolls	Mollisols	Calcium Carbonate Solonchaks.
Osmund	Fine-loamy, mixed	Pachic Cryoborolls	Mollisols	Chernozems.
Paulson	Fine, montmorillonitic	Argic Pachic Cryoborolls	Mollisols	Chernozems.
Redmanson	Loamy-skeletal, carbonatic	Cryic Rendolls	Mollisols	Rendzinas.
Robana	Fine-silty, mixed	Argic Pachic Cryoborolls	Mollisols	Brunizems.
Rooset	Clayey-skeletal, montmorillonitic	Argic Cryoborolls	Mollisols	Chernozems.
Splitro	Loamy, mixed	Lithic Cryoborolls	Mollisols	Lithosols.
Starley	Loamy-skeletal, mixed	Lithic Cryoborolls	Mollisols	Lithosols.
Thayne	Fine-loamy, mixed	Typic Cryoborolls	Mollisols	Chernozems.
Turnerville	Fine-silty, mixed	Typic Cryoboralfs	Alfisols	Gray Wooded soils.
Turson	Fine-loamy over sandy or sandy-skeletal, mixed.	Aquic Cryoborolls	Mollisols	Humic Gleys.
Valleono	Clayey over sandy or sandy-skeletal, montmorillonitic.	Argic Cryoborolls	Mollisols	Chernozems.

[1] Some of the Buckskin soils are taxadjuncts to the Buckskin series and Argaquic Cryoborolls.

SUBORDER: Each order is divided into suborders that are based primarily on those soil characteristics that seem to produce classes with the greatest genetic similarity. The suborders narrow the broad climatic range permitted in the orders. The soil properties used to separate suborders are mainly those that reflect either the presence or absence of water-logging or soil differences resulting from the climate or vegetation. The names of suborders have two syllables. The last syllable indicates the order. An example is Aquoll (*Aqu*, meaning water or wet, and *oll* from Mollisol).

GREAT GROUP: Each suborder is divided into great groups on the basis of uniformity in the kinds and sequence of major soil horizons and features. The horizons used to make separations are those in which clay, iron, or humus have accumulated; those that have pans that interfere with growth of roots, movement of water, or both; and those that have thick, dark-colored surface horizons. The features used are the self-mulching properties of clay, soil temperature, major differences in chemical composition (mainly calcium, magnesium, sodium, and potassium), dark red and dark brown colors associated with basic rocks, and the like. The names of great groups have three or four syllables and are made by adding a prefix to the name of the suborder. An example is Cryaquolls (*Cry*, meaning cold, *aqu* for wetness or water, and *oll* from Mollisols).

SUBGROUP: Each great group is divided into subgroups, one representing the central (typic) segment of the group and others, called intergrades, that have properties of the group and also one or more properties of another great group, suborder, or order. Subgroups may also be made in those instances where soil properties integrade outside of the range of any other great group, suborder, or order. The names of subgroups are derived by placing one or more adjectives before the name of the great group. An example is Typic Cryaquolls (a typical Cryaquoll).

FAMILY: Each subgroup is divided into families primarily on the basis of properties important to the growth of plants or on the behavior of soils when used for engineering. Among the properties considered are texture, mineralogy, reaction, temperature, permeability, thickness of horizons, and consistence. A family name consists of a series of adjectives preceding the subgroup name. The adjectives are the class names for texture, mineralogy, and so on that are used as family differentiae. An example is the clayey over loamy-skeletal, montmorillonitic family of Typic Cryaquolls.

Laboratory Analysis

Table 8 shows the results of laboratory analyses of various samples taken from selected soil profiles. The samples were analyzed and the determinations made by the SCS Soil Survey Laboratory, Riverside, California, according to SCS procedures (*8*). Results are reported for the fine earth fraction (material less than 2 millimeters in diameter) unless otherwise indicated. Short descriptions of the analyses follow. The method codes refer to the SCS procedure used to make the determinations.

Particle-size distribution is the amount of particles of various sizes in the material less than 2 millimeters in diameter. After the organic matter is destroyed, the sand fractions are determined by sieving and the silt and clay fractions by sedimentation (Method 3A1).

Reaction is the pH (hydrogen ion concentration) measured with a glass electrode in a 1:1 soil-water suspension (Method 8C1a).

Organic carbon is the carbon in organic matter determined by wet combustion (Method 6A1a). Most organic matter contains about 58 percent carbon. Hence, the percentage organic carbon multiplied by 1.72 gives the percentage of organic matter.

Carbonate as $CaCO_3$ is calcium and magnesium carbonate (limestone) expressed as calcium carbonate. It is determined by treatment with hydrochloric acid and measuring the amount of carbon dioxide formed in a manometer (Method 6E1b).

Exchangeable bases is the basic cations (Ca, Mg, Na, K) held by the soil, expressed in milliequivalents per 100 grams of soil and determined by measuring the amount of basic cations in the ammonium acetate solution used to saturate the soil in the cation exchange capacity determination. Carbonates, if present, are dissolved in this analysis (Method 5B1a).

Cation exchange capacity is the ability of the soil to hold cations, expressed in milliequivalents per 100 grams of soil, determined by saturating the soil with an ammonium acetate solution at pH 7.0 and measuring the amount of ammonium retained (Method 5A1a).

Base saturation is the sum of bases expressed as a percentage of the cation exchange capacity as specified.

Bulk density, 1/3 bar, is the weight in grams of a unit volume (in cubic centimeters) of undisturbed soil. Bulk density is determined from the volume of the soil clod used for water content at 1/3 bar (Method 4A1d).

Water content, 1/3 bar, is the percentage of water held by the soil against a pressure of 1/3 bar (5 pounds per square inch). The water content at 1/3 bar approximates field capacity if underlying horizons do not contrast greatly in texture or otherwise restrict water movement. The 1/3-bar water retention is measured by equilibrating undisturbed soil clods in a pressure cooker apparatus (Method 4B1c).

Water content, 15 bar, is the amount of water held by the soil against a pressure of 15 bar (220 pounds per square inch). This water generally cannot be used by crops. Fifteen-bar retention is measured on crushed samples in a pressure membrane apparatus (Method 4B2).

All of the soils are described in general in the section "Descriptions of the Soils." The specific profiles for which data are shown in table 8 are described in the following pages.

Representative profile of Hobacker gravelly loam (69Wyo–12–5) on northwest edge of Afton, Wyoming, near creamery, 900 feet west and 20 feet north of southeast corner of NE¼ sec. 25, T. 32 N., R. 119 W., Lincoln County, Wyoming:

Ap—0 to 9 inches, brown (7.5YR 5/2) gravelly loam, dark brown (7.5YR 3/2) moist; moderate, very fine, subangular blocky structure; soft, very friable, slightly sticky and slightly plastic; many micro to medium roots and few coarse roots; 15 percent rounded fragments less than 19 millimeters in diameter, 5 percent between 19 and 76 millimeters; noncalcareous; mildly alkaline (pH 7.6); abrupt, smooth boundary.

TABLE 8.—*Laboratory analyses*

[Dashes indicate that analysis was made but no results were obtained.

Soil, sample number, and sample location	Horizon	Depth from surface	Coarse fragments (76–2.0 mm)	Particle-size distribution					
				Very coarse and coarse sand (2.0–0.05 mm)	Medium sand (0.5–0.25 mm)	Fine sand (0.25–0.10 mm)	Very fine sand (0.10–0.05 mm)	Silt (0.05–0.002 mm)	Clay (<0.002 mm)
		In	*Pct of whole soil*	*Pct*	*Pct*	*Pct*	*Pct*	*Pct*	*Pct*
Hobacker gravelly loam:									
69 WYO 12–5.	Ap	0–9	37	13.2	3.1	9.5	8.6	46.7	18.9
NW edge of Afton near	A12	9–23	77	11.2	3.4	11.8	9.1	48.5	16.0
creamery, 900 feet W and	IIC1	23–39	90	48.6	8.5	11.0	4.9	21.0	6.0
20 feet N of SE corner of	IIC2	39–67	91	43.1	8.5	7.6	3.3	25.5	12.0
NE¼ sec. 25, T. 32 N., R. 119 W., Lincoln County, Wyoming. (Nonmodal)[1]									
Paulson silty clay loam:									
69 WYO 12–7.	Ap	0–11		1.2	.5	6.4	7.6	51.9	32.4
3 miles W of Afton, 710 feet	A12	11–18		.2	.1	2.2	6.6	57.7	33.2
S and 290 feet E of NW	B1	18–31		.2	.2	3.0	9.7	51.4	35.5
corner of NE¼NE¼ sec.	B21t	31–39		.6	.6	3.2	8.3	41.8	45.5
33, T. 32 N., R. 119 W.,	B22t	39–54		.5	.7	4.2	8.1	42.1	44.4
Lincoln County Wyoming.	B3	54–64	5	2.7	1.7	9.9	16.7	44.6	24.4
(Nonmodal)[1]	C1ca	64–77		2.3	2.2	4.2	6.6	57.7	27.0
	C2ca	77–89		1.3	1.5	6.3	15.4	55.3	20.2
Robana silt loam:									
69 WYO 12–9.	Ap	0–5		.5	.1	1.6	9.9	66.3	21.6
About 2½ miles E of Free-	A12	5–16		.2	.1	1.2	7.0	70.2	21.3
dom, 840 feet S and 70 feet	B21t	16–27		.1	.1	.9	10.5	67.3	21.1
E of NW corner sec. 36, T	B22t	27–34		.1		.8	10.8	65.3	23.0
35 N., R. 119 W., Lincoln	B3	34–56		.2	.3	.9	8.8	66.0	23.8
County, Wyoming.	C	56–76		.3	.5	1.7	9.0	66.9	21.6
(Nonmodal)[1]	IIIB21t	76–89		3.0	3.1	5.5	6.7	47.8	33.9

[1] This soil is nonmodal. The main differences between this profile and the modal profile are the thickness of some of the horizons

A12—9 to 23 inches, brown (7.5YR 5/3) gravelly loam, dark brown (7.5YR 3/2) moist; weak, very fine, subangular blocky structure; soft, very friable, slightly sticky and slightly plastic; many micro to fine roots, common medium roots, and few coarse roots; 25 percent rounded fragments less than 19 millimeters in diameter, 15 percent between 19 and 76 millimeters, 5 percent more than 76 millimeters; lime coatings on undersides of some of the fragments; calcareous; mildly alkaline (pH 7.6); clear, wavy boundary.

IIC1—23 to 39 inches, light-brown (7.5YR 6/3) very gravelly sandy loam, dark brown (7.5YR 4/3) moist; massive; loose, nonsticky and nonplastic; common fine roots; 50 percent rounded fragments less than 19 millimeters in diameter, 20 percent between 19 and 76 millimeters, 10 percent between 76 and 254 millimeters, 5 percent more than 254 millimeters; concretions of secondary lime on undersides of most of the fragments; calcareous; moderately alkaline (pH 8.2); gradual, wavy boundary.

IIC2—39 to 67 inches, brown (7.5YR 5/3) very gravelly loam, dark brown (7.5YR 4/4) moist; massive; loose, nonsticky and nonplastic; 35 percent rounded fragments less than 19 millimeters in diameter, 35 percent between 19 and 76 millimeters, 10 percent between 76 and 254 millimeters, 5 percent more than 254 millimeters; lime coatings on undersides of fragments; calcareous; moderately alkaline (pH 8.2).

Profile of Paulson silty clay loam (S69Wyo–12–7) 3 miles west of Afton, Wyoming, 710 feet south and 290 feet east of northwest corner of NE¼NE¼ sec. 33, T. 32 N., R. 119 W., Lincoln County, Wyoming:

Ap—0 to 11 inches, dark reddish-gray (5YR 4/2) silty clay loam, dark reddish brown (5YR 2/2) moist; moderate, medium, granular structure; hard, friable, very sticky and plastic; many micro to coarse roots; noncalcareous; mildly alkaline (pH 7.6); abrupt, smooth boundary.

A12—11 to 18 inches, dark reddish-gray (5YR 4/2) silty clay loam, dark reddish brown (5YR 2/2) moist; weak, medium, subangular blocky structure parting to moderate, very fine, subangular blocky; hard, friable, very sticky and plastic; many micro to coarse roots; common very fine tubular pores; many earthworm castings; noncalcareous; mildly alkaline (pH 7.6); gradual, wavy boundary.

B1—18 to 31 inches, dark reddish-gray (5YR 4/2) silty clay, dark reddish brown (5YR 2/2) moist; weak, fine, prismatic structure parting to moderate, fine and very fine, subangular blocky; very hard, very firm, very sticky and plastic; common micro to coarse roots; common very fine tubular pores; noncalcareous; mildly alkaline (pH 7.6); clear, wavy boundary.

B21t—31 to 39 inches, reddish-gray (5YR 5/2) clay, dark reddish brown (5YR 3/3) moist; weak, medium,

of selected soil profiles

Blank spaces indicate that no analysis was made or that the data are not applicable]

Reaction ($CaCl_2$)	Organic carbon	Carbonate as $CaCO_3$	Exchangeable bases				Cation exchange capacity (NH_4OAc)	Base saturation (NH_4OAc)	Bulk density (⅓ bar)	Water content	
			Calcium	Magnesium	Sodium	Potassium				⅓ bar	15 bar
pH	*Pct*	*Pct*	*Meq per 100 g of soil*	*Meq per 100 g of soil*	*Meq per 100 g of soil*	*Meq per 100 g of soil*	*Meq per 100 g of soil*	*Pct*	*G per cu cm*	*Pct*	*Pct*
7.0	3.41	----------	22.1	4.8	0.1	0.5	23.9	100	1.11	22.9	13.1
7.1	2.01	2	21.3	4.2	.1	.3	18.9	100			10.2
7.1	0.50	40	18.7	1.1	.1	.1	4.2	100			3.7
7.3	0.62	38	21.5	1.5	----------	.1	5.8	100			5.3
7.2	3.86	1	34.9	4.4	.2	1.7	29.0	100	1.17	34.2	16.5
7.2	3.29	2	36.0	5.9	.3	.6	30.2	100	1.22	30.0	17.7
7.1	2.15	----------	26.1	5.5	.3	.8	29.0	100	1.45	20.6	14.6
7.1	0.96	----------	23.6	6.7	.4	.6	28.6	100	1.57	22.1	15.3
7.1	0.96	----------	25.3	6.9	.4	.6	29.5	100	1.53	24.8	15.4
7.4	0.51	8	27.5	4.6	.2	.3	16.9	100	1.38	21.9	9.5
7.6	0.47	34	30.7	4.5	.3	.3	18.7	100	1.44	24.6	11.3
7.4	0.38	21	29.3	4.0	.2	.3	15.3	100	1.53	20.8	9.1
5.7	2.22		13.5	2.3	.1	1.3	19.4	89	1.13	23.3	10.2
5.5	1.49		12.2	2.5	.1	.9	17.9	88	1.24	22.8	9.9
5.6	0.94		10.8	3.0	.1	1.1	16.2	93	1.19	13.9	9.5
5.7	0.68		12.9	4.0	.1	1.1	18.7	97	1.34	20.3	10.3
6.0	0.56		12.7	4.0	.1	.6	17.8	98	1.34	25.5	10.4
6.4	0.42		11.7	3.4	.2	.3	15.1	100	1.28	26.3	9.5
6.6	0.37		16.7	4.2	.2	.6	21.8	100	1.43	25.9	14.0

and the location from which samples were taken.

prismatic structure parting to moderate, medium and fine, subangular blocky; very hard, very firm, very sticky and plastic; few very fine to coarse roots; many very fine to medium tubular pores; common thin clay film on ped faces; noncalcareous; mildly alkaline (pH 7.6); gradual, wavy boundary.

B22t—39 to 54 inches, reddish-gray (5YR 5/2) clay, dark reddish brown (5YR 3/3) moist; weak, medium, prismatic structure parting to moderate, medium and fine, subangular blocky; very hard, very firm, very sticky and plastic; few very fine to coarse roots; many very fine to medium tubular pores; many thin clay films on ped faces; noncalcareous; mildly alkaline (pH 7.6); clear, wavy boundary.

B3—54 to 64 inches, reddish-brown (2.5YR 5/4) silty clay loam, dark red (2.5YR 3/6) moist; weak, medium, prismatic structure parting to weak, fine and very fine, subangular blocky; hard, friable, very sticky and plastic; very few very fine roots; many very fine to medium tubular pores; noncalcareous; mildly alkaline (pH 7.6); clear, wavy boundary.

C1ca—64 to 77 inches, pale-red (2.5YR 6/2) silty clay loam, reddish brown (2.5YR 4/4) moist; weak, very fine, subangular blocky structure; hard, friable, very sticky and plastic; common, very fine to medium, tubular pores; secondary lime disseminated; calcareous; moderately alkaline (pH 8.2); gradual, wavy boundary.

C2ca—77 to 89 inches, pale-red (2.5YR 6/2) silty clay loam, reddish brown (2.5Y 4/4) moist; massive; hard, friable, sticky and plastic; common very fine to medium tubular pores; secondary lime disseminated; calcareous; moderately alkaline (pH 8.2).

Profile of Robana silt loam (S69Wyo–12–9) 2½ miles east of Freedom, Wyoming, 840 feet south and 70 feet east of northwest corner of sec. 36, T. 35 N., R. 119 W., Lincoln County, Wyoming:

Ap—0 to 5 inches, grayish-brown (10YR 5/2) silt loam, very dark grayish brown (10YR 3/2) moist; moderate, fine, granular structure; soft, very friable, slightly sticky and slightly plastic; many very fine to medium roots; noncalcareous; neutral (pH 7.2). abrupt, smooth boundary.

A12—5 to 16 inches, brown (10YR 5/3) silt loam, dark brown (10YR 3/3) moist; moderate, fine, subangular blocky structure; slightly hard, very friable, sticky and slightly plastic; many to common very fine to medium roots; noncalcareous; neutral (pH 7.0); clear, wavy boundary.

B21t—16 to 27 inches, brown (7.5YR 5/2) silty clay loam, dark brown (7.5YR 4/2) moist; weak, fine, prismatic structure parting to strong, medium and fine, subangular blocky; hard, firm, sticky and plastic; few very fine to fine roots; few thin patchy clay films on ped faces; some gray coatings on peds; noncalcareous; neutral (pH 7.0); gradual, wavy boundary.

B22t—27 to 34 inches, brown (7.5YR 5/3) silty clay loam,

dark brown (7.5YR 4/3) moist; weak, medium, prismatic structure parting to strong, medium and fine, angular blocky; hard, firm, very sticky and plastic; few very fine to fine roots; thin patchy clay films on all ped faces; gray coatings on peds; noncalcareous; neutral (pH 7.0); clear, smooth boundary.

B3—34 to 56 inches, light-brown (7.5YR 6/3) silty clay loam, dark brown (7.5YR 4/3) moist; weak, coarse, angular blocky structure parting to moderate, fine, angular blocky; hard, friable, sticky and plastic; few patchy clay films on some ped faces; few gray coatings on peds; noncalcareous neutral (pH 7.2); gradual, wavy boundary.

C—56 to 76 inches, light-brown (7.5YR 6/4) silty clay loam, dark brown (7.5YR 4/4) moist; weak, coarse to fine, angular blocky structure; slightly hard, friable, very sticky and plastic; noncalcareous; mildly alkaline (pH 7.3); clear, wavy boundary.

IIB2t—76 to 104 inches, brown (7.5YR 5/4) silty clay, dark brown (7.5YR 4/4) moist; weak, coarse, prismatic structure parting to weak, coarse, angular blocky; hard, firm, very sticky and plastic; thin, nearly continuous clay films; noncalcareous; mildly alkaline (pH 7.4); abrupt, wavy boundary. (Only the upper 13 inches was sampled for laboratory characterization.)

General Nature of the Area

This section tells about the physiography, relief, and drainage of Star Valley, the climate, the history and development, and farming.

Physiography, Relief, and Drainage

Star Valley Area lies within the Wasatch section of the Middle Rocky Mountain Province of the Rocky Mountain System (*3*). The valley is bordered on the east by the Salt River Range, in which peaks rise above 10,000 feet; on the west by the Caribou and Webster Ranges, in which peaks rise above 8,000 feet; and on the south by the Gannett Hills, which have elevations of more than 8,000 feet. Tygee Ridge runs north and south along the state line west of Afton and separates the upper valley proper from the Tygee Creek Valley and Hardmans Hollow. The valley floor rises from about 5,600 feet above sea level at the north end to about 7,000 feet at the south end.

Salt River and its tributaries drain the Area. The Salt River enters the valley at the south end and flows almost due north for about 45 miles to where it empties into the Snake River. Palisades Reservoir, on the Snake River, inundates several sections of bottom land at the junction of the two rivers when it is full. The largest tributary of Salt River, Crow Creek, originates in the Preuss Range in Idaho. The Salt River runs underground for a few miles in the upper valley during periods of low runoff in fall and winter. The steep gradient of the tributaries flowing from the Salt River Range is used to provide pressure for gravity-flow sprinkler irrigation systems. A narrow gap created by a fault in the rock formation known as "The Narrows" impedes the flow of Salt River and causes the valley's largest "wet" area, which extends for several miles upstream.

Climate[6]

Star Valley Area is along the west-central border of Wyoming, is oriented north and south, and is roughly 10 to 15 miles wide and 45 miles long. The Salt River Range forms the eastern border of the valley and has peaks between 10,000 and 11,000 feet above sea level. The western border of the valley is formed by mountains in Idaho that have elevations of about 9,000 feet. The Salt River flows north through the valley to join the Snake River. Because mountains surround the Area, winds are generally quite light. Cold airmasses from Canada seldom invade the valley, because they are blocked by the massive mountain ranges to the north and east. However, cold air can endure in the Valley. Snow cover on the ground generally persists from late in fall through spring, becoming deep enough to have a blanket effect on the ground so that frost seldom penetrates more than a few inches below the surface. The climate of Star Valley Area is cold and is characterized by humid winters.

The high elevation and dry air of the Area permit rapid gain and loss of solar radiation. Thus, the valley is subject to wide and sometimes abrupt changes in temperature and weather. The temperature varies widely from summer to winter and from day to night. Temperatures as high as 98° F at Afton and 97° at Bedford and as low as −55° at Afton and −46° at Bedford have been recorded. Tables 9, 10, and 11 summarize detailed weather data at the Afton Weather Station.

Because radiation cooling at night is rapid, freezes are common even in summer. If July 25–26 (approximate top of annual temperature curve) is used as the dividing point between the last season and the next season, Afton has a 30-day average period of freeze-free weather (32° F base), ranging from 1 to 63 days; Bedford has a 47-day average period, ranging from 3 to 92 days, although temperatures of 32° are scattered throughout the summer. Using the same dividing point, the average last occurrence of 28° for the last season is June 24 at Afton and June 7 at Bedford. The average first temperature of 28° for the next season is August 25 at Afton and September 5 at Bedford, and the average growing season for 28° is 62 days at Afton and 90 days at Bedford. There are no guarantees, however, that temperatures cannot drop to 28° any time in summer, and 20 percent of the time the temperature can drop to 28° or lower after July 9 at Afton and after June 27 at Bedford. Also, in 20 percent of the years, temperature is expected to drop to 28° or lower before August 12 at Afton and before August 22 at Bedford.

Annual precipitation is about 18 inches at Afton and 21 inches at Bedford. It is fairly even throughout the year except in July, August, and September, when amounts drop to about an inch of moisture per month. Normally, only about 11 percent (2.3 inches) of annual precipitation at Afton and 18 percent (3.8 inches) at Bedford falls between the average 28° freeze-free dates. The most precipitation measured in any one month at Afton was 6.5 inches in May 1906, and at

[6] By JOHN D. ALYEA, climatologist for Wyoming, National Weather Service, U.S. Department of Commerce.

TABLE 9.—*Temperature and precipitation data*

[Data from Afton, elevation 6,210 feet; period of record, 1931–60]

Month	Temperature				Precipitation				
	Average daily high	Average daily low	Two years in 10 will have at least 4 days with—		One year in 10 will have—		Snow and sleet		
			Maximum temperature equal to or higher than—	Minimum temperature equal to or lower than—	Less than—	More than—	Average total	Monthly maximum	Daily maximum
	°F	°F	°F	°F	In	In	In	In	In
January	25.7	0.9	41	−24	0.68	2.69	18.8	45.4	10
February	31.7	3.9	43	−21	.64	2.50	18.3	45.7	28
March	38.9	10.7	49	−12	.45	2.40	15.6	31.8	18
April	51.1	23.1	67	9	.71	2.52	8.6	25.5	10
May	63.9	31.1	77	22	.87	2.98	2.1	14.8	6
June	71.3	35.3	84	28	.74	4.18	0.3	3.5	4
July	82.1	38.9	90	31	.26	2.07	0	0	0
August	80.7	36.9	89	28	.33	2.75	0	0	0
September	72.7	30.7	84	20	.28	2.79	0.4	6.4	5
October	60.5	23.9	76	13	.33	2.88	3.5	20.0	9
November	40.9	13.3	58	−7	.54	2.71	13.9	33.3	12
December	29.4	4.9	43	−19	.65	2.50	18.6	43.0	12
Year	54.1	21.1					100.1		

TABLE 10.—*Probabilities of last freezing temperatures in spring and first in fall*

Probability	Dates for given probability and temperatures [1]		
	16° F or lower	20° F or lower	24° F or lower
Spring:			
1 year in 10 later than	May 7	May 28	June 12
2 years in 10 later than	April 30	May 21	June 5
5 years in 10 later than	April 17	May 8	May 23
Fall:			
1 year in 10 earlier than	September 18	September 3	August 21
2 years in 10 earlier than	September 25	September 10	August 28
5 years in 10 earlier than	October 9	September 24	September 11

[1] See text for discussion of freeze-free periods for 28° and 32°.

Bedford it was 6.12 inches in December 1955 and again in May 1957. Afton has had 4 months that had no precipitation and Bedford has had 2. The greatest snowfalls measured in any one month was 49.0 inches in January 1929 at Afton and 61.5 inches in January 1936 at Bedford. The greatest 2-month snowfall in the valley was at Bedford, in January and February 1936, when 121.7 inches fell. The greatest seasonal snowfall at Afton was 185.6 inches in 1961–62, and at Bedford it was 205.1 inches in 1935–36. The least seasonal snowfall at Afton was 73.2 inches in 1965–66, and at Bedford it was 72.5 inches in 1946–47. Average snowfall is 96.8 inches at Afton and 131.9 inches at Bedford.

Sunshine is quite abundant in the Area, especially in summer. There is no record of sunshine duration in the Area, but it is estimated to average about 60 percent of possible annual sunshine, ranging from about

TABLE 11.—*Evapotranspiration and precipitation data*

Month	Afton				Bedford			
	Average precipitation	Maximum potential evapotranspiration	Potential evapotranspiration at 28° [1]	Average precipitation minus potential evapotranspiration	Average precipitation	Maximum potential evapotranspiration	Potential evapotranspiration at 28° [1]	Average precipitation minus potential evapotranspiration
	In	*In*	*In*	*In*	*In*	*In*	*In*	*In*
January	1.53	0	0	+1.53	2.11	0	0	+2.11
February	1.51	0	0	+1.51	1.95	0	0	+1.95
March	1.55	0	0	+1.55	2.02	0	0	+2.02
April	1.52	0.86	0	+0.66	1.67	0.91	0	+0.76
May	1.95	2.49	0	−0.54	2.13	2.43	0	−0.30
June	1.96	3.40	0.68	−1.44	2.08	3.29	2.52	−1.21
July	1.06	4.43	4.43	−3.37	0.93	4.48	4.48	−3.55
August	1.05	3.85	3.10	−2.80	1.04	4.01	4.01	−2.97
September	1.16	2.54	0	−1.38	1.25	2.59	0.43	−1.33
October	1.53	1.34	0	+0.19	1.57	1.34	0	+0.23
November	1.52	0	0	+1.52	1.78	0	0	+1.78
December	1.59	0	0	+1.59	2.18	0	0	+2.18
Year	17.93	18.91	8.21	−0.98	20.71	19.05	11.44	+1.67

[1] Calculated from the last 28° temperature in spring to the first in fall.

40 percent in winter to about 80 percent in summer.

Relative humidity is comparatively low during the year and is estimated to average about 60 percent annually. It ranges from about 75 percent in December to about 45 percent in August. The daily range is estimated to run from 80 percent in early morning to 70 percent in the heat of the day in December, and in August the range is estimated to be 65 percent to 25 percent for the same times.

Wind is generally quite light and variable in the valley; but during thunderstorms, gusts can occasionally reach 80 to 100 miles per hour. The wind in daytime is typically stronger than at night.

History and Development

Before migrants came to Star Valley, the Shoshone and Blackfoot Indians used the site as a summer hunting ground. About 50 years prior to settlement of the valley, pathfinders, trappers, and traders traveled to the area. Members of Wilson Price Hunt's Astorians worked the area in 1812.

From 1856 to the late 1860's, immigrants enroute to Oregon passed through Star Valley on the Lander Trail, a cutoff from the Oregon Trail, which entered the valley from the southeast. They crossed Salt River and continued up Stump Creek Canyon. The first saltworks were located at the mouth of Stump Creek, the present site of Auburn.

Mormons from Utah and Idaho moved into the valley during the summer of 1879. They settled in the upper valley near the present sites of Afton and Auburn and in the lower valley near what is now Freedom. As a result of a very severe winter in 1883–84, resources were greatly exhausted, and most of the settlers left the valley. By the spring of 1885 only two families remained in Auburn. In 1886, and for several years thereafter, however, an influx of immigrants insured the successful settlement of Star Valley.

Industry

The townsite of Afton was surveyed in 1886. Also, in that year a steam sawmill was built in Grover Canyon and another on Swift Creek. In 1964 a large sawmill began operating north of Afton. This sawmill uses timber from the surrounding national forests and produces 2 by 4 studding.

About 1900 the first creamery was started at Osmund. Dairying became the major farm enterprise. Since that time, almost every community has supported one or more creameries. Surplus butter and cheese are transported to other areas.

Production of Swiss cheese started at Freedom in 1926. Subsequently, six plants started production both in the upper valley and in the lower valley. In 1946 a large plant at Thayne was constructed, and now all production is concentrated there.

Star Valley has one high school in Afton, which serves the entire valley, and grade schools in Afton, Thayne, and Etna.

Farming

Growing feed for livestock on range and on irrigated and dryfarmed cropland is an important enterprise in the Star Valley Area. Good yields of alfalfa-bromegrass hay and barley are obtained by good management of irrigation water and by a good fertilizer program. Dairy cattle are the most important livestock, but beef cattle and sheep are also important.

Some whole milk is hauled out of the valley by tank truck, but most of it is processed by the Swiss cheese factory at Thayne or by the dried-milk and butter

plant at Afton.

Because of frost hazard and distance from markets, specialty crops are a high risk venture. For a short time turkeys were raised on a commercial scale on a few farms.

Since Star Valley Area is composed of parts of three counties in two states, statistics for the Area are not available.

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Glossary

Alluvial fan. A fan-shaped deposit of sand, gravel, and fine material dropped by a stream where its gradient lessens abruptly.

Alluvium. Soil material, such as sand, silt, or clay, that has been deposited on land by streams.

Available water capacity (also termed available moisture capacity). The capacity of soils to hold water available for use by most plants. It is commonly defined as the difference between the amount of soil water at field capacity and the amount at wilting point. It is commonly expressed as inches of water per inch of soil.

Bedrock. The solid rock that underlies the soil and other unconsolidated material or that is exposed at the surface.

Channery soil. A soil that contains thin, flat fragments of sandstone, or schist, as much as 6 inches in length along the longer axis. A single piece is called a fragment.

Clay. As a soil separate, the mineral soil particles less than 0.002 millimeter in diameter. As a soil textural class, soil material that is 40 percent or more clay, less than 45 percent sand, and less than 40 percent silt.

Cobbles. Rounded or partly rounded fragments of rock, 3 to 10 inches in diameter.

Colluvium. Soil material, rock fragments, or both, moved by creep, slide, or local wash and deposited at the base of steep slopes.

Consistence, soil. The feel of the soil and the ease with which a lump can be crushed by the fingers. Terms commonly used to describe consistence are—

Loose.—Noncoherent when dry or moist; does not hold together in a mass.

Friable.—When moist, crushes easily under gentle pressure between thumb and forefinger and can be pressed together into a lump.

Firm.—When moist, crushes under moderate pressure between thumb and forefinger, but resistance is distinctly noticeable.

Plastic.—When wet, readily deformed by moderate pressure but can be pressed into a lump; will form a "wire" when rolled between thumb and forefinger.

Sticky.—When wet, adheres to other material, and tends to stretch somewhat and pull apart, rather than to pull free from other material.

Hard.—When dry, moderately resistant to pressure; can be broken with difficulty between thumb and forefinger.

Soft.—When dry, breaks into powder or individual grains under very slight pressure.

Cemented.—Hard and brittle; little affected by moistening.

Drainage class (natural). Refers to the conditions of frequency and duration of periods of saturation or partial saturation that existed during the development of the soil, as opposed to altered drainage, which is commonly the result of artificial drainage or irrigation but may be caused by the sudden deepening of channels or the blocking of drainage outlets. Seven different classes of natural soil drainage are recognized.

Excessively drained soils are commonly very porous and rapidly permeable and have a low water-holding capacity.

Somewhat excessively drained soils are also very permeable and are free from mottling throughout their profile.

Well-drained soils are nearly free from mottling and are commonly of intermediate texture.

Moderately well drained soils commonly have a slowly permeable layer in or immediately beneath the solum. They have uniform color in the A and the upper B horizons and mottling in the lower B and the C horizons.

Somewhat poorly drained soils are wet for significant periods but not all the time, and some soils commonly have mottling at a depth below 6 to 16 inches.

Poorly drained soils are wet for long periods and are light gray and generally mottled from the surface downward, although mottling may be absent or nearly so in some soils.

Very poorly drained soils are wet nearly all the time. They have a dark-gray or black surface layer and are gray or light gray, with or without mottling, in the deeper parts of the profile.

Effervescence. The fizz obtained when dilute hydrochloric acid is applied to a soil that contains free carbonates.

Erosion. The wearing away of the land surface by wind (sandblast), running water, and other geological agents.

Flood plain. Nearly level land, consisting of stream sediments, that borders a stream and is subject to flooding unless protected artificially.

Gravel. Rounded or angular rock fragments that are not prominently flattened and are as large as 3 inches in diameter.

Horizon, soil. A layer of soil, approximately parallel to the surface, that has distinct characteristics produced by soil-forming processes. These are the major horizons:

O horizon.—The layer of organic matter on the surface of a mineral soil. This layer consists of decaying plant residues.

A horizon.—The mineral horizon at the surface or just below an O horizon. This horizon is the one in which living organisms are most active and therefore is marked by the accumulation of humus. The horizon may have lost one or more of soluble salts, clay, and sesquioxides (iron and aluminum oxides).

B horizon.—The mineral horizon below an A horizon. The B horizon is in part a layer of change from the overlying A to the underlying C horizon. The B horizon also has distinctive characteristics caused (1) by accumulation of clay, sesquioxides, humus, or some combination of these; (2) by prismatic or blocky structure; (3) by redder or stronger colors than the A horizon; or (4) by some combination of these. Combined A and B horizons are usually called the solum, or true soil. If a soil lacks a B horizon, the A horizon alone is the solum.

C horizon.—The weathered rock material immediately beneath the solum. In most soils this material is presumed to be like that from which the overlying horizons were formed. If the material is known to be different from that in the solum, a Roman numeral precedes the letter C.

R layer.—Consolidated rock beneath the soil. The rock usually underlies a C horizon but may be immediately beneath an A or B horizon.

Leaching. The removal of soluble material from soil or other material by percolating water.

Loess. Fine-grained material, dominantly of silt-sized particles, that has been deposited by wind.

Mottling, soil. Irregularly marked with spots of different colors that vary in number and size. Mottling in soils usually indicates poor aeration and lack of drainage. Descriptive terms are as follows: abundance—*few, common,* and *many;* size—*fine, medium,* and *coarse;* and contrast—*faint, distinct,* and *prominent.* The size measurements are these: *fine,* less than 5 millimeters (about 0.2 inch) in diameter along the greatest dimension; *medium,* ranging from 5 millimeters to 15 millimeters (about 0.2 to 0.6 inch) in diameter along the greatest dimension; and *coarse,* more than 15 millimeters (about 0.6 inch) in diameter along the greatest dimension.

Munsell notation. A system for designating color by degrees of the three simple variables—hue, value, and chroma. For example, a notation of 10YR 6/4 is a color with a hue of 10YR, a value of 6, and a chroma of 4.

Parent material. Disintegrated and partly weathered rock from which soil has formed.

Permeability. The quality that enables the soil to transmit water or air. Terms used to describe permeability are as follows: *very slow, slow, moderately slow, moderate, moderately rapid, rapid,* and *very rapid.*

Profile, soil. A vertical section of the soil through all its horizons and extending into the parent material.

Reaction, soil. The degree of acidity or alkalinity of a soil, expressed in pH values. A soil that tests to pH 7.0 is precisely neutral in reaction because it is neither acid nor alkaline. An acid, or "sour," soil is one that gives an acid reaction; an alkaline soil is one that is alkaline in reaction. In words, the degrees of acidity or alkalinity are expressed thus:

	pH		*pH*
Extremely acid	Below 4.5	Neutral	6.6 to 7.3
Very strongly acid	4.5 to 5.0	Mildly alkaline	7.4 to 7.8
Strongly acid	5.1 to 5.5	Moderately alkaline	7.9 to 8.4
Medium acid	5.6 to 6.0	Strongly alkaline	8.5 to 9.0
Slightly acid	6.1 to 6.5	Very strongly alkaline	9.1 and higher

Relief. The elevations or inequalities of a land surface, considered collectively.

Residuum. Unconsolidated, partly weathered mineral material that accumulates over disintegrating solid rock. Residual material is not soil but is frequently the material in which a soil forms.

Runoff (hydraulics). The part of the precipitation on a drainage area that is discharged from the area in stream channels. The water that flows off the land surface without sinking in is called surface runoff; that which enters the ground before reaching surface streams is called ground-water runoff or seepage flow from ground water.

Sand. Individual rock or mineral fragments in a soil that range in diameter from 0.05 to 2.0 millimeters. Most sand grains consist of quartz, but they may be of any mineral composition. The textural class name of any soil that contains 85 percent or more sand and not more than 10 percent clay.

Silt. Individual mineral particles in a soil that range in diameter from the upper limit of clay (0.002 millimeter) to the lower limit of very fine sand (0.05 millimeter). Soil of the silt textural class is 80 percent or more silt and less than 12 percent clay.

Slope. The incline of the surface of a soil; the change in elevation over distance. Generally expressed as percentage, which is the number of feet of rise in 100 feet of run. The slope classes used in this survey are—

Slope range *Pct*	Simple slopes	Complex slopes
0 to 3	nearly level	nearly level
3 to 6	gently sloping	undulating
6 to 10	sloping	undulating
10 to 20	moderately steep	hilly
20 to 40	steep	steep
more than 40	very steep	very steep

Soil. A natural, three-dimensional body on the earth's surface that supports plants and that has properties resulting from the integrated effect of climate and living matter acting on earthy parent material, as conditioned by relief over periods of time.

Solum. The upper part of a soil profile, above the parent material, in which the processes of soil formation are active. The solum in mature soil includes the A and B horizons. Generally, the characteristics of the material in these horizons are unlike those of the underlying material. The living roots and other plant and animal life characteristic of the soil are largely confined to the solum.

Structure, soil. The arrangement of primary soil particles into compound particles or clusters that are separated from adjoining aggregates and have properties unlike those of an equal mass of unaggregated primary soil particles. The principal forms of soil structure are—*platy* (laminated), *prismatic* (vertical axis of aggregates longer than horizontal), *columnar* (prisms with rounded tops), *blocky* (angular or subangular), and *granular. Structureless* soils are either *single grained* (each grain by itself, as in dune sand) or *massive* (the particles adhering together without any regular cleavage, as in many claypans and hardpans).

Subsoil. Technically, the B horizon; roughly, the part of the solum below plow depth.

Substratum. Technically, the part of the soil below the solum.

Subsurface layer. A term used in nontechnical soil descriptions for one or more layers beneath the surface layer but above the subsoil; generally, the A2 horizon.

Surface layer. A term used in nontechnical soil descriptions for one or more layers above the subsoil. Generally, the A, A1, or Ap horizon.

Terrace (geological). An old alluvial plain, ordinarily flat or undulating, bordering a river, lake, or the sea. Stream terraces are frequently called second bottoms, as contrasted to flood plains, and are seldom subject to overflow. Marine terraces were deposited by the sea and are generally wide.

Texture, soil. The relative proportions of sand, silt, and clay particles in a mass of soil. The basic textural classes, in order of increasing proportion of fine particles, are *sand, loamy sand, sandy loam, loam, silt loam, silt, sandy clay loam, clay loam, silty clay loam, sandy clay, silty clay,* and *clay.* The sand, loamy sand, and sandy loam classes may be further divided by specifying "course," "fine," or "very fine."

Tilth, soil. The condition of the soil in relation to the growth of plants, especially soil structure. Good tilth refers to the friable state and is associated with high noncapillary porosity and stable, granular structure. A soil in poor tilth is nonfriable, hard, nonaggregated, and difficult to till.

Underlying layer. A term used in nontechnical soil descriptions for one or more layers under the solum.

Upland (geology). Land consisting of material unworked by water in recent time and lying, in general, at a higher elevation than the alluvial plain or stream terrace. Land above the lowland along rivers.

Water table. The highest part of the soil or underlying rock material that is wholly saturated with water. In some places an upper, or perched, water table may be separated from a lower one by a dry zone.

GUIDE TO MAPPING UNITS

For a full description of a mapping unit read both the description of the mapping unit and that of the soil series to which the mapping unit belongs. All dryland capability units are described on pages 30 and 31, and all irrigated capability units are described on pages 33 and 34. Other information is given in tables as follows:

Acreage and extent, table 1, page 5.
Predicted yields, table 2, page 36.
Engineering uses of the soils, tables 3, 4, and 5, pages 42 through 59.
Recreational uses of the soils, table 6, page 63.

Map symbol	Mapping unit	Page	Capability unit Dryland	Capability unit Irrigated	Range site	
			Symbol	Symbol	Name	Page
Bc	Buckskin silt loam	6	IIIw-62	------	Subirrigated	38
BDC	Buckskin-Decross association, undulating	7	-------	------	Loamy	37
	Buckskin silt loam, 3 to 10 percent slopes	--	IIIe-1	IVe-1	----------	--
	Decross loam, 3 to 10 percent slopes	--	IIIe-2	IVe-2	----------	--
BDD	Buckskin-Decross association, hilly	7	-------	------	Loamy	37
	Buckskin silt loam, 10 to 20 percent slopes	--	IVe-1	------	----------	--
	Decross loam, 10 to 20 percent slopes	--	IVe-2	------	----------	--
COE	Cowdrey clay loam, 10 to 30 percent slopes	8	VIe-1	------	----------	--
CR	Cryaquolls and Cryaquepts	8	Vw-64	------	Wetland	39
Dm	Dipman silty clay loam	9	Vw-64	------	Wetland	39
DN	Dipman-Narrows association	9	Vw-64	------	Wetland	39
Gg	Greyback gravelly loam	10	VIs-9	IVs-9	Loamy	37
GHE	Greyback and Hobacker soils, 0 to 30 percent slopes	10	VIe-1	------	----------	--
	Greyback gravelly loam, 0 to 30 percent slopes	--	-------	------	Loamy	37
	Hobacker gravelly loam, 0 to 30 percent slopes	--	-------	------	Loamy	37
	Greyback cobbly loam, 0 to 30 percent slopes	--	-------	------	Gravelly	37
	Hobacker cobbly loam, 0 to 30 percent slopes	--	-------	------	Gravelly	37
GRD	Greyback-Rooset association, hilly	11	-------	------	----------	--
	Greyback gravelly loam, 10 to 30 percent slopes	--	VIe-1	------	Loamy	37
	Rooset gravelly loam, 10 to 30 percent slopes	--	VIe-1	------	Loamy	37
	Decross loam, 10 to 30 percent slopes	--	VIe-1	------	Loamy	37
GRE	Greyback-Rooset association, steep	11	VIIe-1	------	----------	--
	Greyback gravelly loam, 30 to 60 percent slopes	--	-------	------	Steep Stony	38
	Rooset gravelly loam, 30 to 60 percent slopes	--	-------	------	Steep Stony	38
	Decross loam, 30 to 60 percent slopes	--	-------	------	Steep Loamy	38
Hb	Hobacker gravelly sandy loam	12	VIs-9	IVs-9	Loamy	37
Hc	Hobacker gravelly loam	12	VIs-9	IVs-9	Loamy	37
Hd	Hobacker cobbly loam	12	VIs-9	Vs-9	Gravelly	37
HgD	Hobacker-Osmund gravelly loams, 6 to 20 percent slopes	12	VIe-1	------	Loamy	37
HOE	Hobacker-Osmund gravelly loams, 20 to 30 percent slopes	12	VIe-1	------	Loamy	37
HuA	Huffine silt loam, 0 to 3 percent slopes	13	IIIs-2	IIIs-2	Loamy	37
HuB	Huffine silt loam, 3 to 6 percent slopes	13	IIIe-2	IIIe-2	Loamy	37
LC	Lail-Cowdrey association	14	VIIe-1	------	----------	--
Le	Leavittville complex	14	IIIs-2	IIIs-2	Loamy	37
OmA	Osmund and Mundos loams, 0 to 3 percent slopes	17	IIIs-2	IIIs-2	Loamy	37
OmB	Osmund and Mundos loams, 3 to 6 percent slopes	17	IIIe-2	IIIe-2	Loamy	37
OnA	Osmund and Mundos gravelly loams, 0 to 3 percent slopes	17	IIIs-2	IIIs-2	Loamy	37
OnB	Osmund and Mundos gravelly loams, 3 to 6 percent slopes	18	IIIe-2	IIIe-2	Loamy	37
PaA	Paulson silty clay loam, 0 to 3 percent slopes	18	IIIc-1	IIIc-1	Loamy	37
PaB	Paulson silty clay loam, 3 to 6 percent slopes	19	IIIe-1	IIIe-1	Loamy	37
PaC	Paulson silty clay loam, 6 to 10 percent slopes	19	IIIe-1	------	Loamy	37
PaD	Paulson silty clay loam, 10 to 20 percent slopes	19	IVe-1	------	Loamy	37

Map symbol	Mapping unit	Page	Capability unit Dryland	Capability unit Irrigated	Range site	Page
PKF	Paulson-Rock land complex, 30 to 60 percent slopes	19	VIIe-1	------	----------	--
	Paulson silty clay loam, 30 to 60 percent slopes	--	-------	------	Steep Loamy	38
	Stony rock land	--	-------	------	Very Shallow	39
PL	Paulson-Lail association	19	VIe-1	------	----------	--
	Paulson silty clay loam, 6 to 30 percent slopes	--	-------	------	Loamy	37
	Lail silt loam, 6 to 30 percent slopes	--	-------	------	----------	--
PO	Paulson-Osmund association	19	VIIe-1	------	Steep Loamy	38
PRD	Paulson-Robana association, hilly	19	-------	------	Loamy	37
	Paulson silty clay loam, 10 to 20 percent slopes	--	IVe-1	------	----------	--
	Robana silt loam, 10 to 20 percent slopes	--	IVe-2	------	----------	--
	Buckskin silt loam, 10 to 20 percent slopes	--	IVe-1	------	----------	--
PRE	Paulson-Robana association, steep	20	-------	------	----------	--
	Paulson silty clay loam, 20 to 30 percent slopes	--	VIe-1	------	Loamy	37
	Robana silt loam, 20 to 30 percent slopes	--	VIe-1	------	Loamy	37
	Buckskin silt loam, 20 to 30 percent slopes	--	VIe-1	------	Loamy	37
RD	Redmanson association	20	VIIe-1	------	----------	--
RE	Redmanson-Starley association	20	VIIe-1	------	----------	--
	Redmanson very gravelly silty clay loam, 30 to 60 percent slopes	--	-------	------	Steep Stony	38
	Starley cobbly silty clay loam, 30 to 60 percent slopes	--	-------	------	Shallow Loamy	38
RoA	Robana silt loam, 0 to 3 percent slopes	21	IIIc-2	IIIc-2	Loamy	37
RoC	Robana silt loam, 3 to 10 percent slopes	21	IIIe-2	IVe-2	Loamy	37
RoD	Robana silt loam, 10 to 20 percent slopes	21	IVe-2	------	Loamy	37
RTC	Robana-Turnerville association, undulating	21	IIIe-2	IVe-2	----------	--
	Robana silt loam, 3 to 10 percent slopes	--	-------	------	Loamy	37
	Turnerville silt loam, 3 to 10 percent slopes	--	-------	------	----------	--
RTD	Robana-Turnerville association, hilly	21	IVe-2	------	----------	--
	Robana silt loam, 10 to 20 percent slopes	--	-------	------	Loamy	37
	Turnerville silt loam, 10 to 20 percent slopes	--	-------	------	----------	--
RTE	Robana-Turnerville association, steep	22	VIe-1	------	----------	--
	Robana silt loam, 20 to 30 percent slopes	--	-------	------	Loamy	37
	Turnerville silt loam, 20 to 30 percent slopes	--	-------	------	----------	--
SPE	Splitro complex, 6 to 30 percent slopes	23	VIIe-1	------	Shallow Loamy	38
SSE	Starley cobbly silty clay loam, 6 to 30 percent slopes	24	VIIe-1	------	Shallow Loamy	38
STE	Starley complex, 6 to 30 percent slopes	24	VIIe-1	------	Shallow Loamy	38
SY	Stony rock land	24	VIIe-1	------	Very Shallow	39
TeA	Thayne loam, 0 to 3 percent slopes	25	IIIs-2	IIIs-2	Loamy	37
TeB	Thayne loam, 3 to 6 percent slopes	25	IIIe-2	IIIe-2	Loamy	37
ThA	Thayne gravelly loam, 0 to 3 percent slopes	25	IIIs-2	IIIs-2	Loamy	37
ThB	Thayne gravelly loam, 3 to 6 percent slopes	25	IIIe-2	IIIe-2	Loamy	37
Tu	Turson silt loam	27	IIIw-62	IIIw-62	Subirrigated	38
Va	Valleono silty clay loam	27	IIIs-1	IIIs-1	Loamy	37
WcC	Willow Creek-Bozeman association, undulating	28	-------	------	----------	--
	Willow Creek silt loam, 3 to 10 percent slopes	--	IIIe-2	IVe-2	Loamy	37
	Bozeman silt loam, 3 to 10 percent slopes	--	IIIe-2	IVe-2	Loamy	37
	Robana silt loam, 3 to 10 percent slopes	--	IIIe-2	IVe-2	Loamy	37
WcD	Willow Creek-Bozeman association, hilly	28	-------	------	----------	--
	Willow Creek silt loam, 10 to 20 percent slopes	--	IVe-2	------	Loamy	37
	Bozeman silt loam, 10 to 20 percent slopes	--	IVe-2	------	Loamy	37
	Robana silt loam, 10 to 20 percent slopes	--	IVe-2	------	Loamy	37

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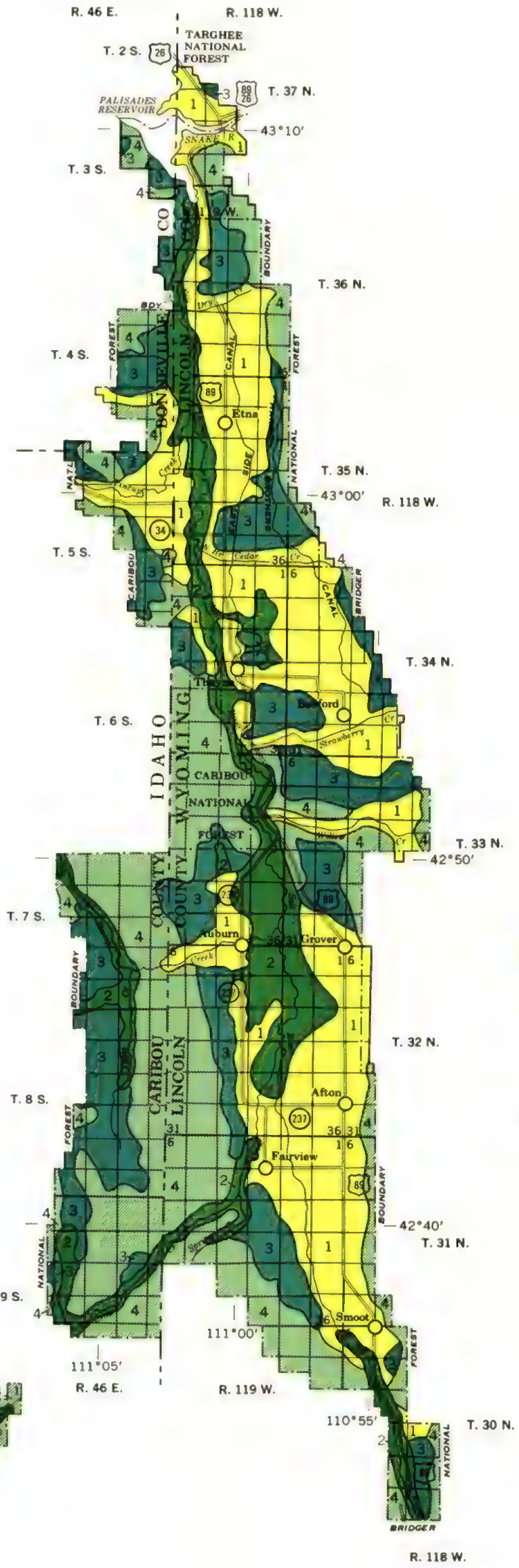


U. S. DEPARTMENT OF AGRICULTURE
SOIL CONSERVATION SERVICE
FOREST SERVICE

IDAHO AGRICULTURAL EXPERIMENT STATION
WYOMING AGRICULTURAL EXPERIMENT STATION

GENERAL SOIL MAP

STAR VALLEY AREA, WYOMING-IDAHO
PARTS OF LINCOLN COUNTY, WYOMING, AND
BONNEVILLE AND CARIBOU COUNTIES, IDAHO

Scale 1:253,440

1 0 1 2 3 4 Miles

N

SOIL ASSOCIATIONS*

1 — Hobacker-Greyback-Leavittville association: Nearly level to gently sloping, somewhat excessively drained and well drained gravelly loams and silt loams on alluvial fans and terraces

3 — Turson-Dipman association: Nearly level, somewhat poorly drained and poorly drained silt loams and silty clay loams on flood plains

3 — Robana-Buckskin-Cowdrey association: Rolling and hilly, deep, well-drained silt loams and clay loams on foot slopes and uplands

4 — Paulson-Lail-Stony rock land association: Steep to very steep, well-drained silty clay loams and silt loams and Stony rock land on foothills and mountains

*Terms for texture refer to the surface layer of the major soils in each association.

Compiled 1974

SECTIONALIZED TOWNSHIP

6	5	4	3	2	1
7	8	9	10	11	12
18	17	16	15	14	13
19	20	21	22	23	24
30	29	28	27	26	25
31	32	33	34	35	36

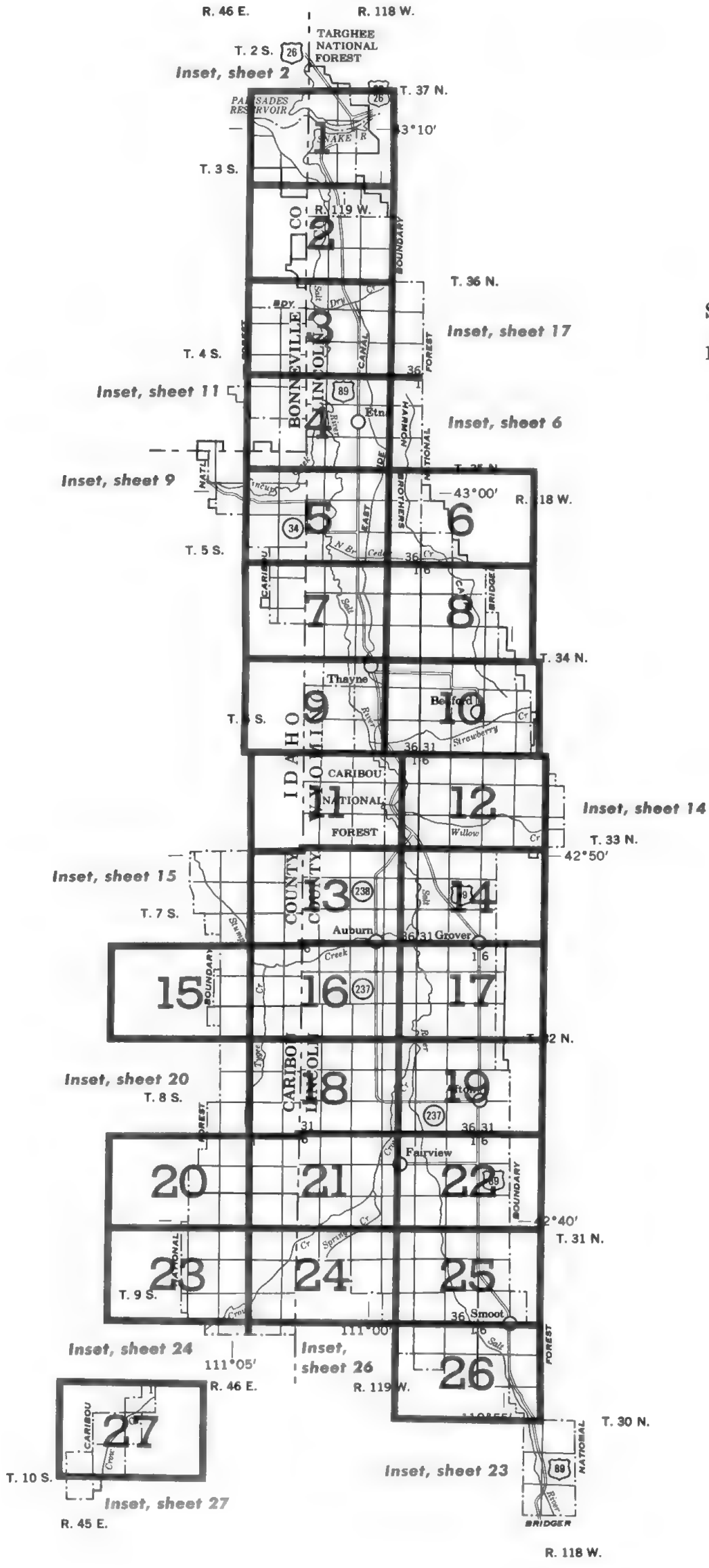
Each area outlined on this map consists of more than one kind of soil. The map is thus meant for general planning rather than a basis for decisions on the use of specific tracts.

INDEX TO MAP SHEETS

STAR VALLEY AREA, WYOMING-IDAHO
PARTS OF LINCOLN COUNTY, WYOMING, AND BONNEVILLE AND CARIBOU COUNTIES, IDAHO

Scale 1:253,440

1 0 1 2 3 4 Miles



SECTIONALIZED TOWNSHIP

6	5	4	3	2	1
7	8	9	10	11	12
18	17	16	15	14	13
19	20	21	22	23	24
30	29	28	27	26	25
31	32	33	34	35	36

STAR VALLEY AREA, WYOMING-IDAHO

CONVENTIONAL SIGNS

WORKS AND STRUCTURES

Highways and roads
- Divided
- Good motor
- Poor motor
- Trail

Highway markers
- National Interstate
- U. S.
- State or county

Railroads
- Single track
- Multiple track
- Abandoned

Bridges and crossings
- Road
- Trail
- Railroad
- Ferry (FY)
- Ford (FORD)
- Grade
- R. R. over
- R. R. under

Buildings
- School
- Church

Mine and quarry

Gravel pit (G.P.)

Power line

Pipeline

Cemetery

Dams

Levee

Tanks

Well, oil or gas

Forest fire or lookout station

Windmill

Located object

BOUNDARIES

- National or state
- County
- Minor civil division
- Reservation
- **Soil survey**
- Small park, cemetery, airport
- Land survey division corners

DRAINAGE

Streams, double-line
- Perennial
- Intermittent

Streams, single-line
- Perennial
- Intermittent
  - Crossable with tillage implements
  - Not crossable with tillage implements
  - Unclassified

Canals and ditches

Lakes and ponds
- Perennial (water, w)
- Intermittent (int)

Spring

Marsh or swamp

Wet spot

Drainage end or alluvial fan

RELIEF

Escarpments
- Bedrock
- Other

Short steep slope

Prominent peak

Depressions

	Large	Small
Crossable with tillage implements		
Not crossable with tillage implements		
Contains water most of the time		

SOIL SURVEY DATA

Soil boundary and symbol (Dx)

Gravel

Stoniness
- Stony
- Very stony

Rock outcrops

Chert fragments

Clay spot

Sand spot

Gumbo or scabby spot

Made land

Severely eroded spot

Blowout, wind erosion

Gully

Saline spot

SOIL LEGEND

The first letter, always a capital, is the initial one of the soil name. The next letter is a capital if the mapping unit is one of the low intensity survey; it is a small letter if the mapping unit is one of the high intensity survey. The last letter, a capital A, B, C, D, E, or F, indicates the slope. Most symbols without a slope letter are those of soils and land types that have a considerable range of slope, but some are for nearly level soils.

SYMBOL		NAME
Low Intensity	High Intensity	
-	Bc	Buckskin silt loam
BDC	-	Buckskin-Decross association, undulating
BDD	-	Buckskin-Decross association, hilly
COE	-	Cowdrey clay loam, 10 to 30 percent slopes
CR	-	Cryaquolls and Cryaquepts
-	Dm	Dipman silty clay loam
DN	-	Dipman-Narrows association
-	Gg	Greyback gravelly loam
GHE	-	Greyback and Hobacker soils, 0 to 30 percent slopes
GRD	-	Greyback-Rooset association, hilly
GRE	-	Greyback-Rooset association, steep
-	Hb	Hobacker gravelly sandy loam
-	Hc	Hobacker gravelly loam
-	Hd	Hobacker cobbly loam
-	HgD	Hobacker-Osmund gravelly loams, 6 to 20 percent slopes
HOE	-	Hobacker-Osmund gravelly loams, 20 to 30 percent slopes
-	HuA	Huffine silt loam, 0 to 3 percent slopes
-	HuB	Huffine silt loam, 3 to 6 percent slopes
LC	-	Lail-Cowdrey association
-	Le	Leavittville complex
-	OmA	Osmund and Mundos loams, 0 to 3 percent slopes
-	OmB	Osmund and Mundos loams, 3 to 6 percent slopes
-	OnA	Osmund and Mundos gravelly loams, 0 to 3 percent slopes
-	OnB	Osmund and Mundos gravelly loams, 3 to 6 percent slopes
-	PaA	Paulson silty clay loam, 0 to 3 percent slopes
-	PaB	Paulson silty clay loam, 3 to 6 percent slopes
-	PaC	Paulson silty clay loam, 6 to 10 percent slopes
-	PaD	Paulson silty clay loam, 10 to 20 percent slopes
PKF	-	Paulson-Rock land complex, 30 to 60 percent slopes
PL	-	Paulson-Lail association
PO	-	Paulson-Osmund association
PRD	-	Paulson-Robana association, hilly
PRE	-	Paulson-Robana association, steep
RD	-	Redmanson association
RE	-	Redmanson-Starley association
-	RoA	Robana silt loam, 0 to 3 percent slopes
-	RoC	Robana silt loam, 3 to 10 percent slopes
-	RoD	Robana silt loam, 10 to 20 percent slopes
RTC	-	Robana-Turnerville association, undulating
RTD	-	Robana-Turnerville association, hilly
RTE	-	Robana-Turnerville association, steep
SPE	-	Splitro complex, 6 to 30 percent slopes
SSE	-	Starley cobbly silty clay loam, 6 to 30 percent slopes
STE	-	Starley complex, 6 to 30 percent slopes
SY	-	Stony rock land
-	TeA	Thayne loam, 0 to 3 percent slopes
-	TeB	Thayne loam, 3 to 6 percent slopes
-	ThA	Thayne gravelly loam, 0 to 3 percent slopes
-	ThB	Thayne gravelly loam, 3 to 6 percent slopes
-	Tu	Turson silt loam
-	Va	Valleono silty clay loam
-	WcC	Willow Creek-Bozeman association, undulating
-	WcD	Willow Creek-Bozeman association, hilly

N

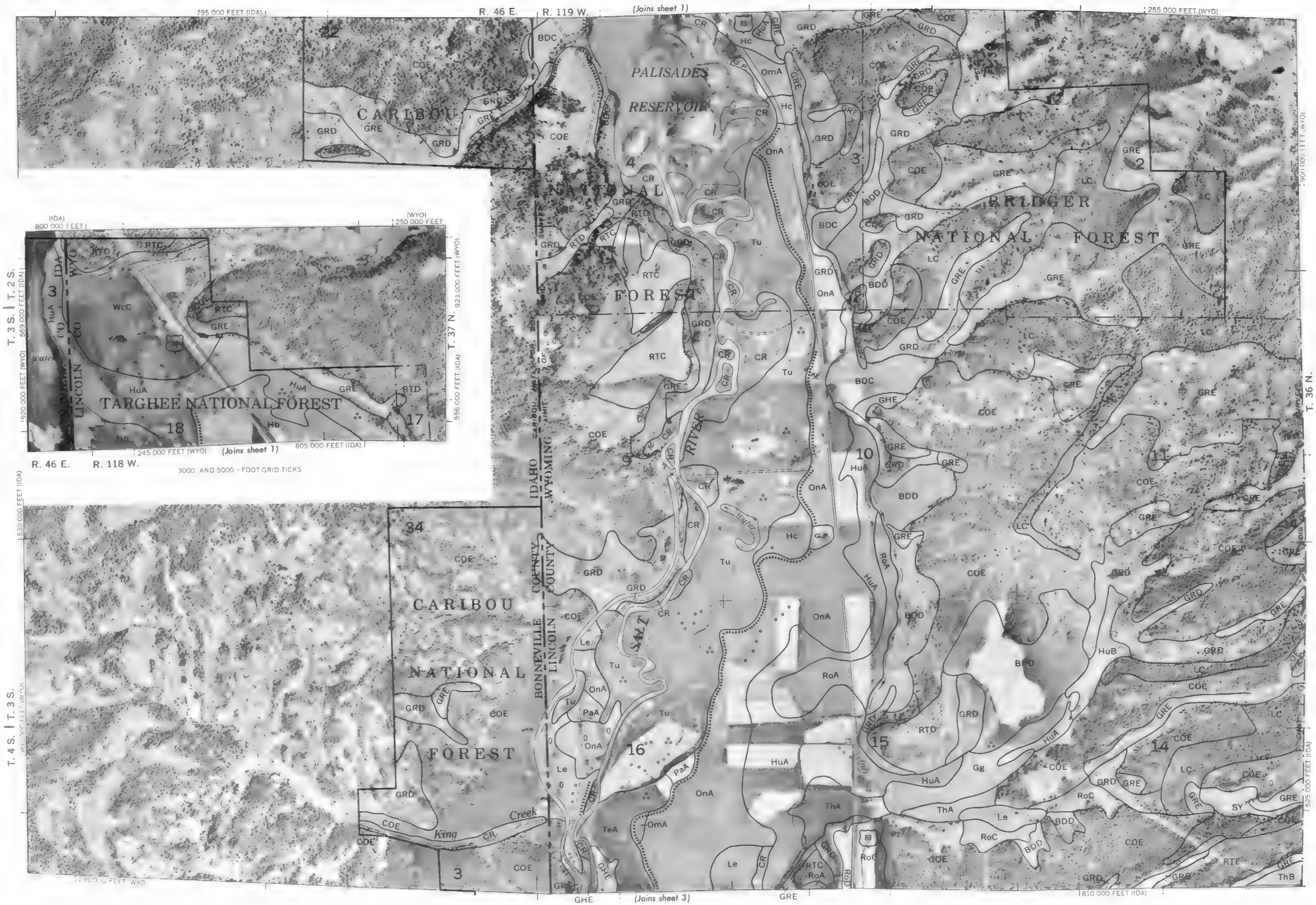
1 Mile
5 000 Feet
Scale 1:20000

This map is one of a set compiled in 1974 as part of a soil survey by the United States Department of Agriculture, Soil Conservation Service, and Forest Service, and the Wyoming Agriculture Experiment Station, and the Idaho Agriculture Experiment Station

Photobase from 1953 through 1967 aerial photography. Position of 5,000-foot grid ticks are approximate and based on the Wyoming coordinate system, West Zone, and the Idaho coordinate system, East Zone

Land division corners are approximately positioned on this map

STAR VALLEY AREA, WYOMING-IDAHO NO. 1



STAR VALLEY AREA, WYOMING-IDAHO NO. 2

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Land division corners are approximately positioned on this map

STAR VALLEY AREA, WYOMING-IDAHO NO. 3

STAR VALLEY AREA, WYOMING-IDAHO NO. 4

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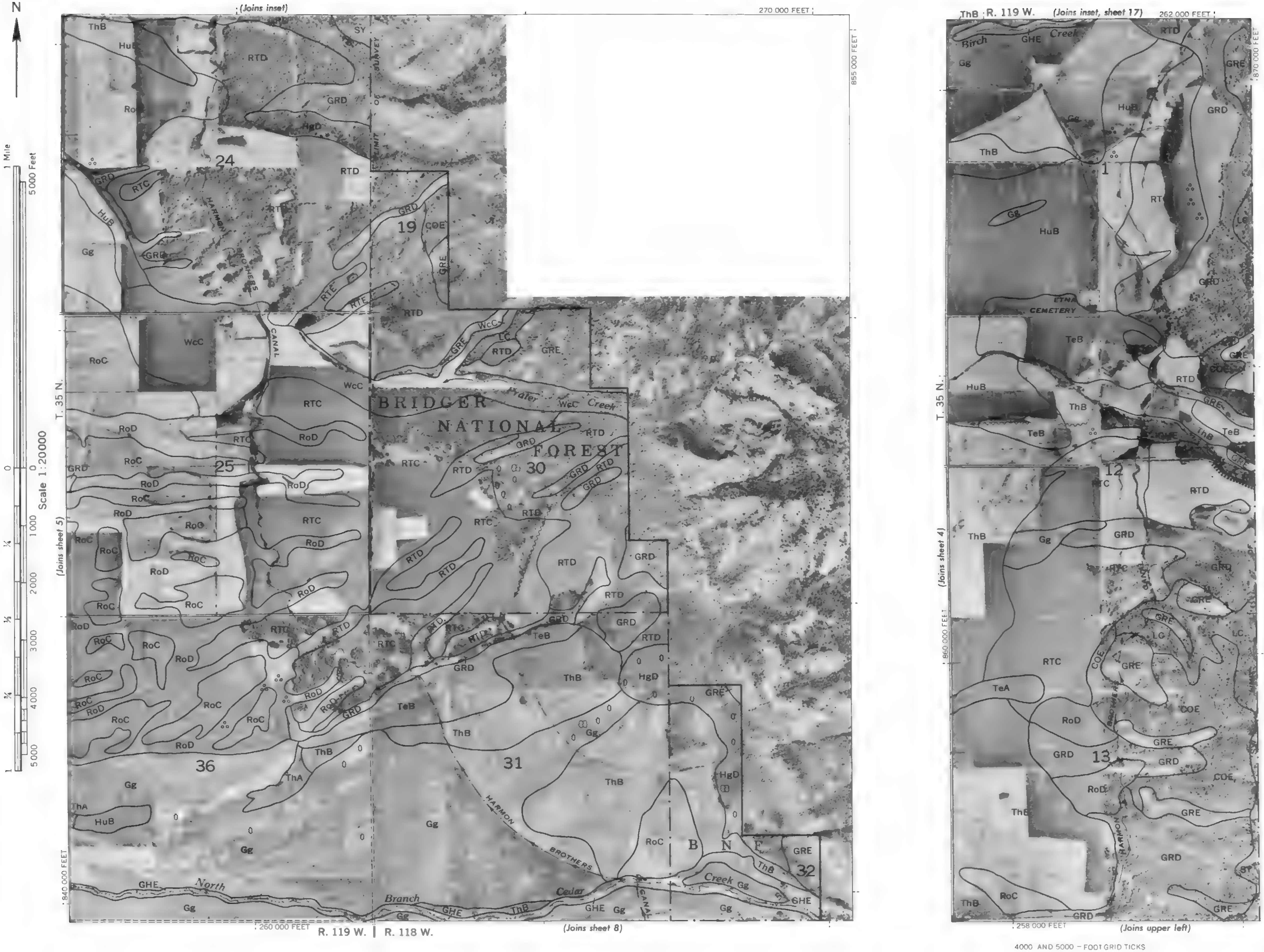
Land division corners are approximately positioned on this map

STAR VALLEY AREA, WYOMING-IDAHO NO. 5



STAR VALLEY AREA, WYOMING-IDAHO NO. 6

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This map is one of a set compiled in 197[illegible] as part of a soil survey by the United States Department of Agriculture, Soil Conservation Service, and Forest Service, and the Wyoming Agriculture Experiment Station, and the Idaho Agriculture Experiment Station

Photobase from 1953 Through 1967 aerial photography. Position of [illegible]

STAR VALLEY AREA, WYOMING-IDAHO NO. 7

STAR VALLEY AREA, WYOMING-IDAHO NO. 8
Land division corners are approximately positioned on this map

Photobase from 1953 through 1967 aerial photography. Position of 5,000-foot grid ticks are approximate and based on the Wyoming coordinate system, West Zone

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Land division corners are approximately positioned on this map.

STAR VALLEY AREA, WYOMING-IDAHO NO. 9

N

(Joins sheet 8)

R. 119 W. | R. 118 W.

BRIDGER

280 000 FEET

T. 34 N.

1 Mile

5000 Feet

Scale 1:20000

(Joins sheet 9)

(Joins sheet 11)

(Joins sheet 12)

Photobase from 1953 Through 1967 aerial photography. Position of 5,000-foot grid ticks are approximate and based on the Wyoming coordinate system, West Zone

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STAR VALLEY AREA, WYOMING-IDAHO — SHEET NUMBER 11

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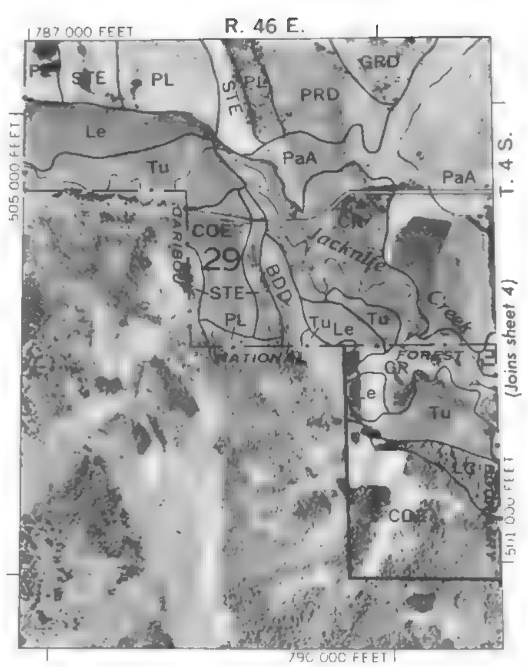
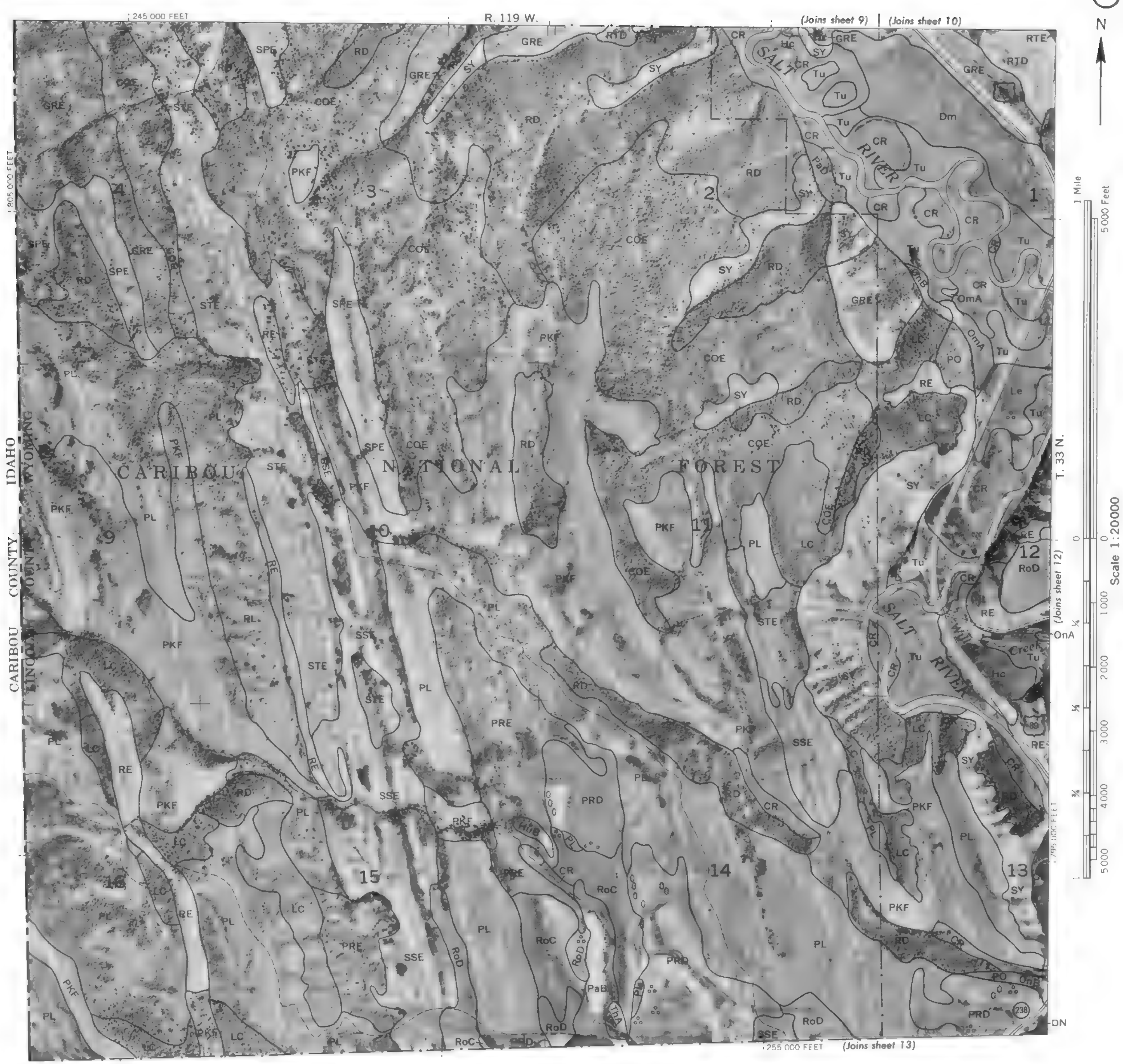
Photobase from 1953 through 1967 aerial photography. Position of 5,000-foot grid ticks are approximate and based on the Wyoming coordinate system, West Zone, and the Idaho coordinate system, East Zone. Land division corners are approximately positioned on this map.

STAR VALLEY AREA, WYOMING-IDAHO NO. 11



3000 AND 4000 – FOOT GRID TICKS



STAR VALLEY AREA, WYOMING-IDAHO — SHEET NUMBER 12

STAR VALLEY AREA WYOMING-IDAHO NO. 12

This map is one of a set compiled in ... as part of a soil survey by the United States Department of Agriculture, Soil Conservation Service and Forest Service, and the Wyoming Agriculture Experiment Station, and the ... Agriculture Experiment Station

(13)

STAR VALLEY AREA, WYOMING-IDAHO NO. 13

N

R. 119 W. | R. 118 W. (Joins sheet 12)

280 000 FEET

R. 118 W. : 285 000 FEET

790 000 FEET

T. 33 N.

1 Mile

5000 Feet

0 0

Scale 1:20000

1 1000 2000 3000 4000 5000

1 ¼ ½ ¾ 1

(Joins sheet 13)

1780 000 FEET

(Joins sheet 17)

1795 000 FEET

1800 000 FEET

(Joins sheet 12)

284 000 FEET

1000 AND 5000 – FOOT GRID TICKS

STAR VALLEY AREA, WYOMING-IDAHO NO. 14

Photobase from 1953 Through 1967 aerial photography. Portion of 5000-foot grid ticks are approximately positioned on this map

Land division corners are approximate and based on the Wyoming coordinate system, West Zone

This map is one of a set compiled in 1974 as part of a soil survey by the United States Department of Agriculture, Soil Conservation Service, and Forest Service, and the Wyoming Agriculture Experiment Station, and the Idaho Agriculture Experiment Station

This map is one of a set compiled in 1974 as part of a soil survey by the United States Department of Agriculture, Soil Conservation Service, and Forest Service, and the Wyoming Agriculture Experiment Station, and the Idaho Agriculture Experiment Station

Photobase from 1953 Through 1967 aerial photography. Position of 5,000-foot grid ticks are approximate and based on the Idaho coordinate system, East Zone

Land division corners are approximately positioned on this map

STAR VALLEY AREA, WYOMING-IDAHO NO. 15

1 Mile

5000 4000 3000 2000 1000 0 5000 Feet

Scale 1:20000

N

15

STAR VALLEY AREA, WYOMING-IDAHO – SHEET NUMBER 15

16

N

R. 119 W.

R. 46 E.

(Joins sheet 13)

255 000 FEET (WYO)

775 000 FEET (WYO)

T. 32 N.

T. 8 S. | T. 7 S.

(Joins sheet 15)

(Joins sheet 17)

(Joins sheet 18)

235 000 FEET (WYO)

IDAHO | WYOMING

CARIBOU | LINCOLN COUNTY

1 Mile

5 000 Feet

Scale 1:20000

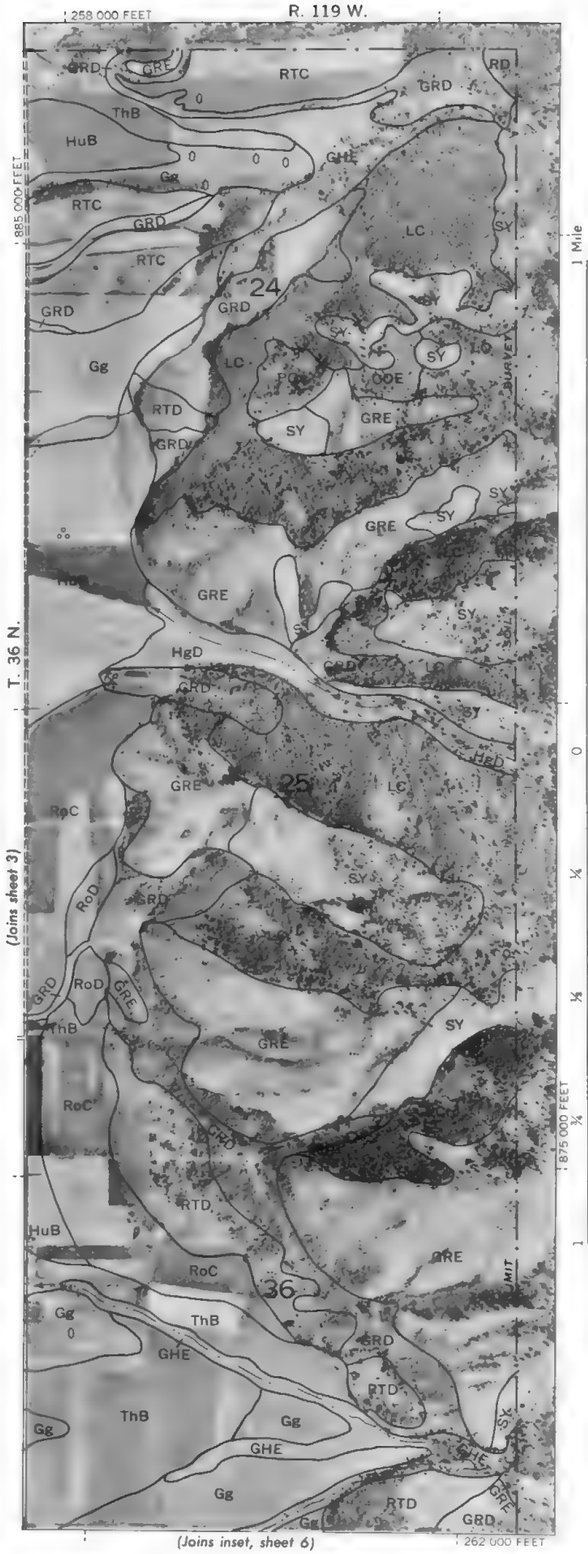
STAR VALLEY AREA, WYOMING - IDAHO NO 16

This map is one of a set compiled in 1974 as part of a soil survey by the United States Department of Agriculture, Soil Conservation Service, and Forest Service, and the Wyoming Agricultural Experiment Station, and the Idaho Agricultural Experiment Station

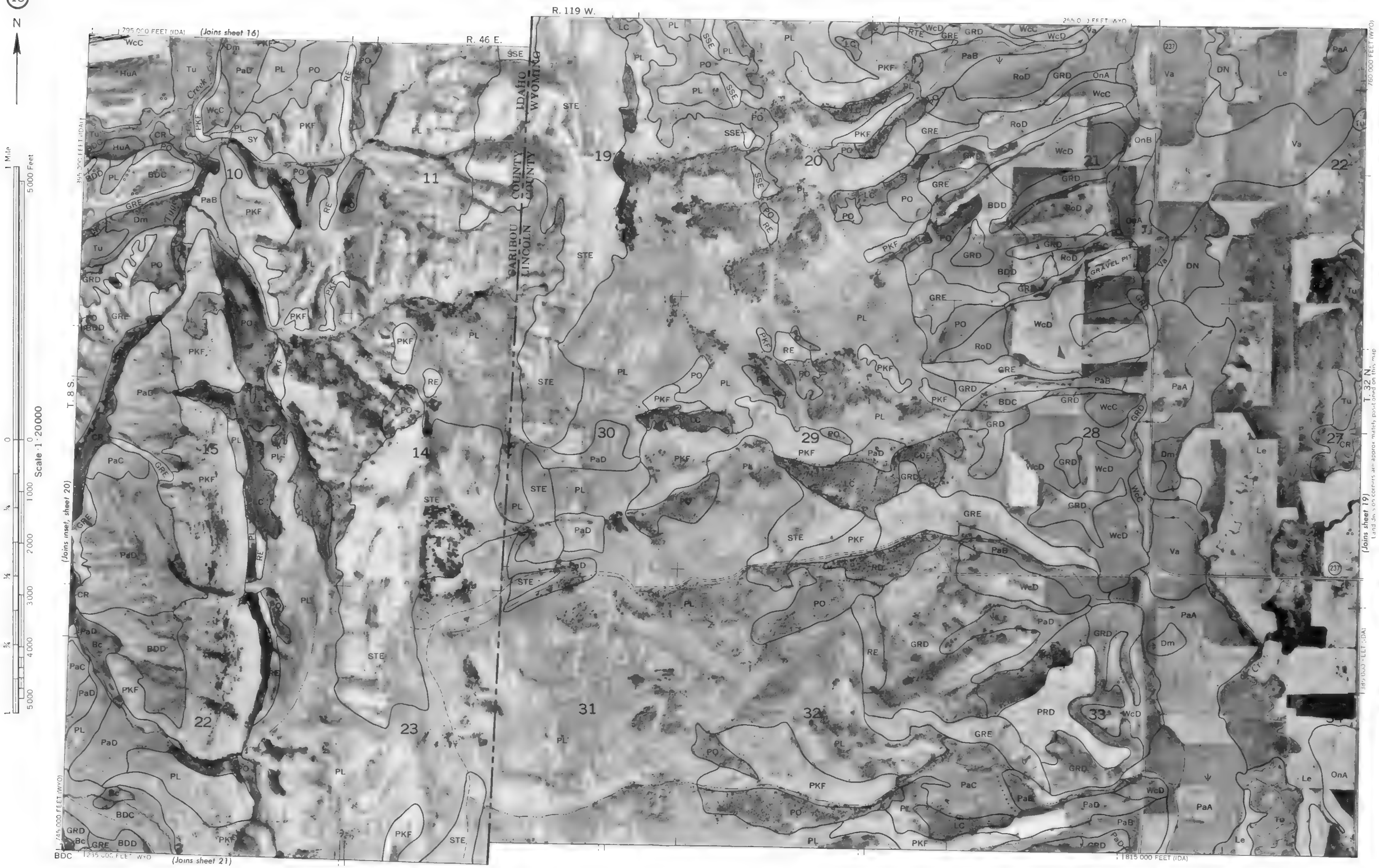
Photobase from 1953 Through 1967 aerial photography. Position of 5,000-foot grid ticks are approximate and based on the Wyoming coordinate system, West Zone.

Land division corners are approximately positioned on this map.

STAR VALLEY AREA, WYOMING - IDAHO NO. 17



4000 AND 5000 – FOOT GRID TICKS



Photobase from 1953 through 1967 aerial photography. Positions of 5,000-foot grid ticks are approximate and based on the Wyoming coordinate system, West Zone, and the Idaho coordinate system, East Zone.

Land divisions corners are approximately positioned on this map.

This map is one of a set compiled in 1974 as part of a soil survey by the United States Department of Agriculture, Soil Conservation Service, and Forest Service, and the Wyoming Agricultural Experiment Station and the Idaho Agriculture Experiment Station.

STAR VALLEY AREA, WYOMING-IDAHO NO. 18

STAR VALLEY AREA, WYOMING-IDAHO — SHEET NUMBER 19

This map is one of a set compiled in 1974 as part of a soil survey by the United States Department of Agriculture, Soil Conservation Service, and Forest Service, and the Wyoming Agriculture Experiment Station, and the Idaho Agriculture Experiment Station

Photobase from 1953 Through 1967 aerial photography. Position of 5,000-foot grid ticks are approximate and based on the Wyoming coordinate system, West Zone

Land division corners are approximately positioned on this map

STAR VALLEY AREA, WYOMING-IDAHO NO. 19

PaA

260 000 FEET

R. 119 W. | R. 118 W.

(Joins sheet 17)

T. 32 N.

(Joins sheet 18)

(Joins sheet 22)

280 000 FEET

750 000 FEET

BRIDGER NAT'L FOR.

SOIL SURVEY BOUNDARY

NATIONAL FOREST BOUNDARY

LIMIT OF SURVEY

Soil

River

Crow

Creek

Strip

water

19

N

1 Mile

5000 Feet

Scale 1:20000

N

R. 46 E.

793 000 FEET

GRD (Joins sheet 15)

395 000 FEET

T. 8 S.

(Joins sheet 18)

385 000 FEET

788 000 FEET

(Joins upper right)

(Joins lower left)

790 000 FEET

R. 46 E.

380 000 FEET

(Joins sheet 21)

T. 9 S. | T. 8 S.

PO

365 000 FEET

785 000 FEET

(Joins sheet 23)

Land division corners are approximately positioned on this map

This map is one of a set compiled in 1974 as part of a soil survey by the United States Department of Agriculture, Soil Conservation Service, and Forest Service, and the Wyoming Agriculture Experiment Station, and the

STAR VALLEY AREA, WYOMING-IDAHO — SHEET NUMBER 21

21

N

R. 119 W.

R. 46 E.

795 000 FEET (IDA)

255 000 FEET (WYO)

(Joins sheet 18)

(Joins sheet 20)

(Joins sheet 22)

(Joins sheet 24)

T. 9 S. | T. 8 S.

T. 31 N.

IDAHO
WYOMING

CARIBOU COUNTY
LINCOLN COUNTY

Hardmans Hollow

Crow Creek

Spring Creek

Fairview

730 000 FEET (WYO)

235 000 FEET (WYO)

815 000 FEET (IDA)

370 000 FEET (IDA)

1 Mile

5 000 Feet

Scale 1:20000

This map is one of a set compiled in 1974 as part of a soil survey by the United States Department of Agriculture, Soil Conservation Service, and Forest Service, and the Wyoming Agriculture Experiment Station, and the Idaho Agriculture Experiment Station.

STAR VALLEY AREA, WYOMING-IDAHO NO. 21

Photobase from 1953 through 1967 aerial photography. Position of 5,000-foot grid ticks are approximate and based on the Wyoming coordinate system, West Zone, and the Idaho coordinate system, East Zone

Land division corners are approximately positioned on this map

STAR VALLEY AREA, WYOMING-IDAHO — SHEET NUMBER 22

N

(Joins sheet 19)

R. 119 W. | R. 118 W.

280 000 FEET

745 000 FEET

T. 31 N.

730 000 FEET

(Joins sheet 21)

(Joins sheet 25)

260 000 FEET

1 Mile

5000 Feet

Scale 1:20000

0 0 ¼ ½ ¾ 1

1000 2000 3000 4000 5000

Land division corners are approximately positioned on this map

Photobase from 1953 Through 1967 aerial photography. Position of 5,000-foot grid ticks are approximate and based on the Wyoming coordinate system, West Zone

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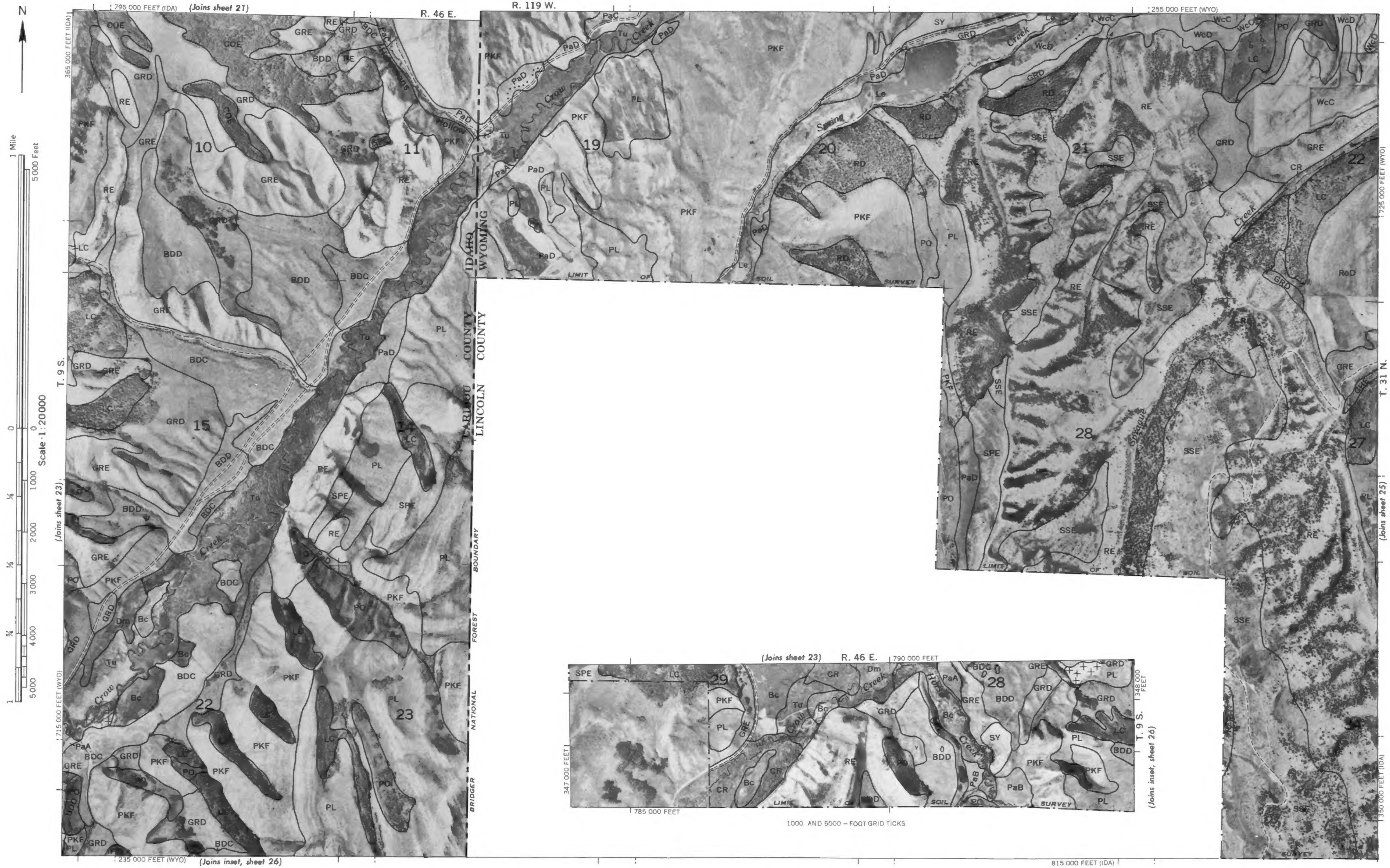
Photobase from 1953 through 1967 aerial photography. Position of 5,000-foot grid ticks are approximate and based on the Wyoming coordinate system, West Zone, and the Idaho coordinate system, East Zone

Land division corners are approximately positioned on this map

STAR VALLEY AREA, WYOMING-IDAHO NO. 23

STAR VALLEY AREA, WYOMING-IDAHO — SHEET NUMBER 24



Land division corners are approximately positioned on this map.

Photobase from 1953 Through 1967 aerial photography. Position of 5,000-foot grid ticks are approximate and based on the Wyoming coordinate system, West Zone, and the Idaho coordinate system, East Zone.

This map is one of a set compiled in 1974 as part of a soil survey by the United States Department of Agriculture, Soil Conservation Service, and Forest Service, and the Wyoming Agricultural Experiment Station, and the Idaho Agricultural Experiment Station.

STAR VALLEY AREA, WYOMING-IDAHO — SHEET NUMBER 25

This map is one of a set compiled in 1974 as part of a soil survey by the United States Department of Agriculture, Soil Conservation Service, and Forest Service, and the Wyoming Agriculture Experiment Station, and the Idaho Agriculture Experiment Station.

Photobase from 1953 Through 1967 aerial photography. Position of 5,000-foot grid ticks are approximate and based on the Wyoming coordinate system, West Zone.

Land division corners are approximately positioned on this map.

STAR VALLEY AREA, WYOMING - IDAHO NO. 25

260 000 FEET

725 000 FEET

R. 119 W.

R. 118 W.

(Joins sheet 22)

T. 31 N.

(Joins sheet 24)

(Joins sheet 26)

280 000 FEET

715 000 FEET

25

N

1 Mile

5000 Feet

Scale 1:20000

N

1 Mile 5000 Feet

Scale 1:20000

(Joins sheet 25)

R. 119 W. | R. 118 W.

280 000 FEET

10 000 FEET

T. 30 N.

700 000 FEET

260 000 FEET

(Joins inset, sheet 23)

(Joins sheet 24)

R. 46 E.

800 000 FEET

347 000 FEET

346 000 FEET

795 000 FEET

T. 9 E.

LINCOLN CO WYO

BOUNDARY

FOREST

NATIONAL

BRIDGER

SOIL SURVEY

1000 AND 5000 – FOOT GRID TICKS

Land division corners are approximately positioned on this map.

Photobase from 1953 Through 1967 aerial photography. Position of 5,000-foot grid ticks are approximate and based on the Wyoming coordinate system, West Zone, and the Idaho coordinate system, East Zone.

This map is one of a set compiled in 1974 as part of a soil survey by the United States Department of Agriculture, Soil Conservation Service, and Forest Service, and the Wyoming Agriculture Experiment Station, and the Idaho Agriculture Experiment Station.

STAR VALLEY AREA, WYOMING-IDAHO — SHEET NUMBER 27

27

N

765 000 FEET

R. 45 E.

335 000 FEET

T. 10 S.

1 Mile

5000 Feet

Scale 1:20000

325 000 FEET

318 000 FEET

785 000 FEET

(Joins inset)

(Joins lower left)

770 000 FEET

3000 AND 5000 – FOOT GRID TICKS

This map is one of a set compiled in 1974 as part of a soil survey by the United States Department of Agriculture, Soil Conservation Service, and Forest Service, and the Wyoming Agriculture Experiment Station, and the Idaho Agriculture Experiment Station.

Photobase from 1953 Through 1967 aerial photography. Position of 5,000-foot grid ticks are approximate and based on the Idaho coordinate system, East Zone. Land division corners are approximately positioned on this map.

STAR VALLEY AREA, WYOMING-IDAHO NO. 27